ENERGY SAVINGS FOR A DATA CENTER

Background

The facilities studied in this audit are two office buildings totaling over 400,000 square feet, with sections dedicated for data centers. The facility had an annual electrical energy consumption of over 12,000,000 kilowatt-hours (kWh) per year and an annual natural gas consumption of over 125,000 therms per year. The total energy costs were estimated to be approximately $1.6 million each year.

Potential Energy Savings

The energy efficiency opportunities recommended could potentially save an estimated 1,141,612 kWh of electrical energy each year, or about 9% of the facility's total electrical energy usage. The recommendations could reduce the facility's electrical demand by about 177 kW. The recommendation could save an estimated 9,603 therms of natural gas each year, or 8% of the plant's total natural gas energy usage. The potential total annual cost savings due to implementing all of the recommended measures was estimated to be approximately $130,200 per year, which represents about 8% of the facility's total energy costs. Total estimated implementation cost was about $265,100 giving an average simple payback of 2 years.

SUMMARY OF ENERGY EFFICIENCY OPPORTUNITIES SAVINGS AND COSTS

Description		Potential Energy Conserved	Demand Savings (kW)	Potential Savings ($/yr)	Implem. Cost ($)	Simple Payback (years)
1. Delamp the Wall-Wash Lights in Corridors		9,109 kWh/yr	3.24	1,292	774	0.6
2. Install Daylight Sensors on Indoor Perimeter Lights		58,496 kWh/yr	32.14	10,041	4,160	0.4
3. Install Temperature Reset Controllers on the Hot Water Boilers		9,603 therms/yr	N/A	9,191	9,902	1.1
4. Cool the Data Center with Outside Air		297,776 kWh/yr	43.39	29,380	34,000	1.2
5. Install Small Heat Pumps for Cooling (and Heating) the Lobbies During Low-Occupancy Periods		271,239 kWh/yr	0.00	23,598	41,750	1.8
6. Install Variable Frequency Drives on Data Center Supply Fans		285,747 kWh/yr	32.62	27,471	75,498	2.7
7. Install Variable Frequency Drives on Air Handler Exhaust Fans		219,245 kWh/yr	65.88	29,225	99,015	3.4
Totals	**(Electricity)**	**1,141,612 kWh/yr**	**177.3 kW**	**$130,198/yr**	**$265,099**	**2.0 years**
	(Natural Gas)	**9,603 therms/yr**				

Potential Demand Response Opportunities

The demand response opportunities identified in this report could reduce the total electrical demand in the facility by approximately 158.8 kW during demand response events. This demand reduction will result in an electrical energy credit of $20,193 per year.

SUMMARY OF DEMAND RESPONSE OPPORTUNITY SAVINGS AND COSTS				
Description	**Demand Reduction** (kW)	**Potential Savings** ($/yr)	**Implem. Cost** ($)	**Simple Payback** (years)
1. Turn Off Unessential Air Handler Compressors During Demand Response Events	129.08	16,411	0	Immediate
2. Turn Off Unessential Lights During Demand Response Events	22.61	2,882	0	Immediate
3. Increase Chilled Water Temperature Setpoint During Demand Response Events	7.13	900	0	Immediate
Totals	**158.8 kW**	**$20,193/yr**	**$0**	**Immediate**

Other Energy System Opportunities

The other energy system opportunity identified in this report, *Install a Combined Heat and Power System*, could result in an annual electrical cost savings of $143,644 per year. The implementation cost is $1,033,735 giving a simple payback of 7.2 years.

SUMMARY OF OTHER ENERGY SYSTEM OPPORTUNITY SAVINGS AND COSTS					
Description	**Potential Energy Produced**	**Demand Reduction** (kW)	**Potential Savings** ($/yr)	**Implem. Cost** ($)	**Simple Payback** (years)
1. Install a Combined Heat and Power System	7,008,000 kWh/yr -771,377 therms/yr	900	143,644	1,033,735	7.2

Implementation Status

Shortly after presenting the report to the facility, the facility submitted the project for incentives from the utility company and is planning to implement several of the recommended energy efficiency measures, including the following:

Measure 2 – Install Daylight Sensors on Indoor Perimeter Lights

Based on a lighting survey conducted during the facility visit and lighting blueprints, it was observed that the perimeter spaces in both buildings received ample light during bright daylight hours. It was recommended that daylight sensors be installed on the indoor perimeter fluorescent fixtures in both buildings to reduce lighting energy consumption during daylight hours. This could result in an electrical energy savings of over 58,000 kWh per year, with a potential demand reduction of approximately 32 kW.

Measure 4 – Cool the Data Center with Outside Air

Chilled water produced at 43°F is circulated through thirteen air conditioning units to provide space cooling for the data center. Generally, chilled water is produced by a 210-ton chiller, but when the outside temperature increases, two back-up chiller units would come online to assist the lead chiller. It was recommended that air provided to the building by the air handling units be ducted into the data center so that cool outside air will be directed (through the economizer) into the data center when the outdoor temperature is favorable. Bringing in cool outside air to the data center when possible will reduce the energy usage by the chilled water system, resulting in an electrical energy savings of over 297,700 kWh per year.

Measure 5 – Install Small Heat Pumps for Cooling (and Heating) the Lobbies During Low-Occupancy Periods

Each of the two buildings utilizes six air handling units to supply conditioned air to various areas in the buildings. Based on conversations with facility personnel regarding the operation of the air handling units, the air handling units are only supposed to operate during normal operating hours. However, during the evenings when the temperature in the building varies, the air handling units would be turned on to provide heating/cooling to the lobby areas in both buildings and are consequently left on overnight. It was recommended that heat pumps be installed to condition the lobby areas of both buildings. The heat pump units will operate more efficiently than the air handling units during the off hours, resulting in electrical energy savings of over 271,000 kWh per year.

All of the recommended demand response opportunities have been implemented by the facility and the facility is currently in the process of exploring the potential for implementing a combined heat and power system depending on the outlook of the company.