

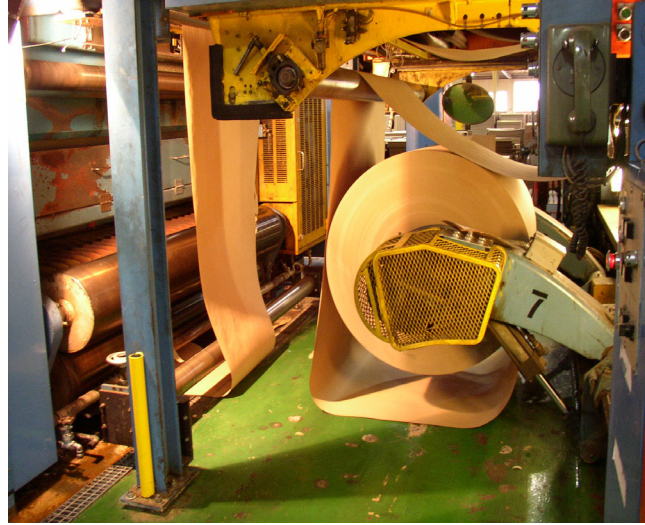
ENERGY SAVINGS FOR A CARDBOARD MANUFACTURING PLANT

Background

This plant manufactures corrugated cardboard boxes. The facility had an annual electrical energy consumption of over 5,100,000 kilowatt-hours (kWh) per year and an annual natural gas consumption of over 276,000 therms per year. The total energy costs were estimated to be approximately \$800,000 each year.

Potential Energy Savings

The energy efficiency opportunities recommended could potentially save an estimated 563,721 kWh of electrical energy each year, or 11% of the plant's total electrical energy usage. The recommendations could reduce the facility's electrical demand by about 101 kW. The recommended measures may reduce the plant's natural gas energy by 82,665 therms per year, or approximately 30% of the plant's total natural gas usage. The potential total annual cost savings due to implementing all of the recommended measures was estimated to be approximately \$105,825 per year, which represents about 13% of the plant's total energy costs. Total estimated implementation cost was about \$137,870 giving an average simple payback of 1.3 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 Repair Compressed Air Leaks	21,000 kWh/yr	7.20	1,935	0	Immed.
2 Repair Steam Leaks	24,732 therms/yr	N/A	12,579	0	Immed.
3 Reduce Operating Pressure of Steam Boiler	2,309 therms/yr	N/A	1,281	150	0.1
4 Replace Standard V-Belts with Cog-Type Belts	15,661 kWh/yr	2.64	1,693	1,070	0.6
5 Install Photoelectric Sensors to Shut-Off the Hogger Drive and Blower When Not in Use	20,596 kWh/yr	7.07	2,722	1,208	0.4
6 Control Boiler to Operate in Low-Fire Mode During Non-Production Hours	42,903 therms/yr	N/A	23,798	1,280	0.1
7 Control Steam Usage in Glue Mixer	2,943 therms/yr	N/A	1,632	1,400	0.9

SUMMARY OF ENERGY EFFICIENCY OPPORTUNITIES SAVINGS AND COSTS (CONTINUED)						
Description	Potential Energy Conserved	Demand Savings (kW)	Potential Savings (\$/yr)	Implem. Cost (\$)	Simple Payback (years)	
8 Clean Existing and Install New Daylight Sensor Controls on Outdoor Lights	23,993 kWh/yr	7.69	3,097	2,076	0.7	
9 Install Premium Efficiency Motors*	16,693 kWh/yr	2.76	1,987	2,255	1.1	
10 Insulate Steam Supply Pipelines Under the Corrugator	1,350 therms/yr	N/A	749	2,500	3.3	
11 Install Lighting Occupancy Sensors Throughout the Facility	8,001 kWh/yr	2.75	1,058	3,434	3.2	
12 Replace 500-Watt Halogen Lights with 150-Watt Metal Halide Lights	11,182 kWh/yr	3.84	1,478	3,504	2.4	
13 Insulate the Hot Plates	8,428 therms/yr	N/A	4,675	7,200	1.5	
14 Sequence Air Compressors and Reduce Discharge Pressure	30,856 kWh/yr	10.60	4,081	8,700	2.1	
15 Interlock Suction Fans with Flexo Machines	251,584 kWh/yr	0.00	21,357	25,543	1.2	
16 Replace Metal Halide Lights with More Efficient T5 or T8 Fluorescent Lights	164,155 kWh/yr	56.37	21,703	77,550	3.6	
Totals	(Electricity)	563,721 kWh/yr	100.9 kW	\$105,825/yr	\$137,870	1.3 years
	(Natural Gas)	82,665 therms/yr				

* Based on two-year savings.

The energy system opportunities identified in the report could reduce the facility's summer peak period demand by up to 1,380 kW. Implementation of these energy system opportunities could translate into a cost savings of about \$133,904 per year giving an immediate payback.

SUMMARY OF ENERGY SYSTEM OPPORTUNITY SAVINGS				
Description	Potential Demand Reduction	Potential Cost Savings (\$/yr)	Implementation Cost (\$)	Simple Payback (years)
1 Delay the Operation of the Flexo-Machines, Trim Hogger System and Large Air Compressor with Advance Notice	614.7 kW*	14,201	0	Immediate
2 Reschedule Facility Operating Hours	1,380 kW*	119,703	0	Immediate

* Summer Peak period.

Implemented Measures

In following up with the plant half a year after submitting the report, the plant had already implemented or was in the planning stages of implementing approximately 75% of the recommended energy efficiency measures. Some of the recommended measures are included as follows:

Measure 6 – Control Boiler to Operate in Low-Fire Mode During Non-Production Hours

The plant uses a 12.553 MMBtu/hr steam boiler to produce steam for the plant's manufacturing process. The boiler produces steam at approximately 175 psig. It is recommended that a more modern boiler controller be installed on the steam boiler system to control the boiler to operate in "low-fire" mode during non-production hours. Operating the boiler at "low-fire" mode during non-production hours will reduce the load of the boiler during the non-production periods, resulting in a natural gas energy savings of over 42,000 therms per year. This measure was implemented immediately after our recommendation

Measure 13 – Insulate the Hot Plates

Insulate the underside of the hot plates of the corrugator. During the audit of the facility, it was noted that the underside of the heating plates (heated by steam) of the corrugator were not insulated. The surface of the plates was measured to be approximately 340 °F. The reduced heat loss from these hot surfaces resulted in natural gas savings of over 8,400 therms per year. This measure was implemented shortly after our recommendation.

Measure 16 – Replace Metal Halide Lights with More Efficient T5 or T8 Fluorescent Lights

Replace existing metal halide lighting throughout the facility with more efficient fluorescent lighting with electronic ballasts. High intensity fluorescents are more efficient than MH lamps and feature lower lumen depreciation rates, better dimming options, instant start-up and better color rendition. The total electrical energy savings due to replacing the metal halide lamps are estimated to be over 164,000 kWh/yr, with a demand reduction of 56 kW. This measure is being planned for implementation in the near future.

The corporate office has taken this energy efficiency report and used it to help implement the recommended measures in other plants.