

# ENERGY SAVINGS FOR A REFINERY

## Background

This plant refines used motor oil. The facility had an annual electrical energy consumption of over 4,500,000 kilowatt-hours (kWh) per year and an annual natural gas consumption of over 2.2 million therms per year. The total energy costs were estimated to be almost \$2 million each year.



## Potential Energy Savings

The energy efficiency opportunities recommended could potentially save an estimated 221,668 kWh of electrical energy each year, or 4.8% of the plant's total electrical energy usage. The recommendations could reduce the facility's electrical demand by about 26 kW. The recommendation could save an estimated 252,633 therms of natural gas each year, or 11.2% 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 \$186,000 per year, which represents about 9.5% of the plant's total energy costs. Total estimated implementation cost was about \$111,000 giving an average simple payback of 0.6 years.

<b>SUMMARY OF ENERGY EFFICIENCY OPPORTUNITIES SAVINGS AND COSTS</b>						
Description	Potential Energy Conserved	Demand Savings (kW)	Potential Savings (\$/yr)	Implem. Cost (\$)	Simple Payback (years)	
1 Tune the Steam Boiler	39,211 therms/yr	N/A	24,797	0	Immediate	
2 Install Daylight Control on the Road Lights behind the Tank Farm	7,862 kWh/yr	1.80	920	710	0.8	
3 Install Occupancy Sensors in the Lab Offices, Locker Room, Storage Spaces, and the Mobile Office	29,548 kWh/yr	3.38	3,014	1,962	0.7	
4 Install Premium Efficiency Motors*	33,413 kWh/yr	2.68	3,434	3,486	1.0	
5 Reduce the Air Compressor Discharge Pressure	15,628 kWh/yr	1.78	1,593	4,570	2.9	
6 Control the Cooling Tower Fan Motor with an Adjustable Speed Drive	67,323 kWh/yr	8.01	6,906	7,101	1.0	
7 Install an Economizer on the Boiler to Preheat the Feedwater	32,438 therms/yr	N/A	21,010	23,000	1.1	
8 Insulate the Hot Surfaces in the Processing Area	180,984 therms/yr	N/A	117,224	32,559	0.3	
9 Replace the Pneumatic Pumps with Positive Displacement Pumps	67,894 kWh/yr	8.08	6,966	37,433	5.4	
<b>Totals</b>	<b>(Electricity)</b>	<b>221,668 kWh/yr</b>	<b>25.7 kW</b>	<b>\$185,864/yr</b>	<b>\$110,821</b>	<b>0.6 years</b>
	<b>(Natural Gas)</b>	<b>252,633 therms/yr</b>				

\* Based on two-year savings.

## 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 many of the recommended energy efficiency measures. Several of the other measures are being evaluated by the plant and possibly planned for implementation in the near future. Some of the recommended measures are included as follows:

### Measure 1 – Tune the Steam Boilers

The plant uses a 150 hp Dixon steam boiler to produce saturated steam. The steam boiler has a forced draft burner with an input rating of 8.96 MMBtu of natural gas per hour. Based on an analysis of 12 months of the plant's natural gas bills and an energy balance of the natural gas consuming equipment at the plant, it is estimated that the steam boiler consumes over 520,000 therms of natural gas per year. While at the facility, the audit team performed a flue gas analysis (FGA) of the steam boiler and found the boiler combustion efficiency is 77.2%. Adjusting the air-to-fuel ratio of the steam boiler to 4% O<sub>2</sub> (about 21% excess air) should produce a combustion efficiency of about 81.3%, resulting in a natural gas savings of over 39,000 therms per year. This measure was implemented immediately after our recommendation

### Measure 8 – Insulate the Hot Surfaces in the Processing Area

Insulate the exposed surfaces of various pipes, tanks, and heat exchangers in the processing area. During the audit of the plant, it was noted that some heated equipment and piping is un-insulated and have surface temperatures as high as 610 °F. The reduced heat loss from these hot surfaces resulted in natural gas savings of over 180,000 therms per year. Upon seeing the significant energy savings that may result from insulation of the plant's hot surfaces, the plant submitted the project for incentives from the utility company, and have planned to implement this measure.