Canadian Manufacturers & Exporters

Case Study

Reducing Overhead Loads at a Machine Shop

Key Opportunity

Reduce or eliminate overhead loads during non-operating hours to reduce energy consumption.

Savings potential: 44,600 kWh/yr

Expected cost: $500

Expected payback: 0.05 years

Applicability: Applicable to non-continuous operations where overhead loads can easily be left on during non-production times.

Introduction

Small CNC machine shops make a variety of components. The smaller shops typically run single shift operations (5 days per week). Overhead loads such as ventilation, lighting, air conditioning, and compressed air support the operations of these machine shops. Optimizing these loads in alignment with operating hours can significantly reduce overhead costs.

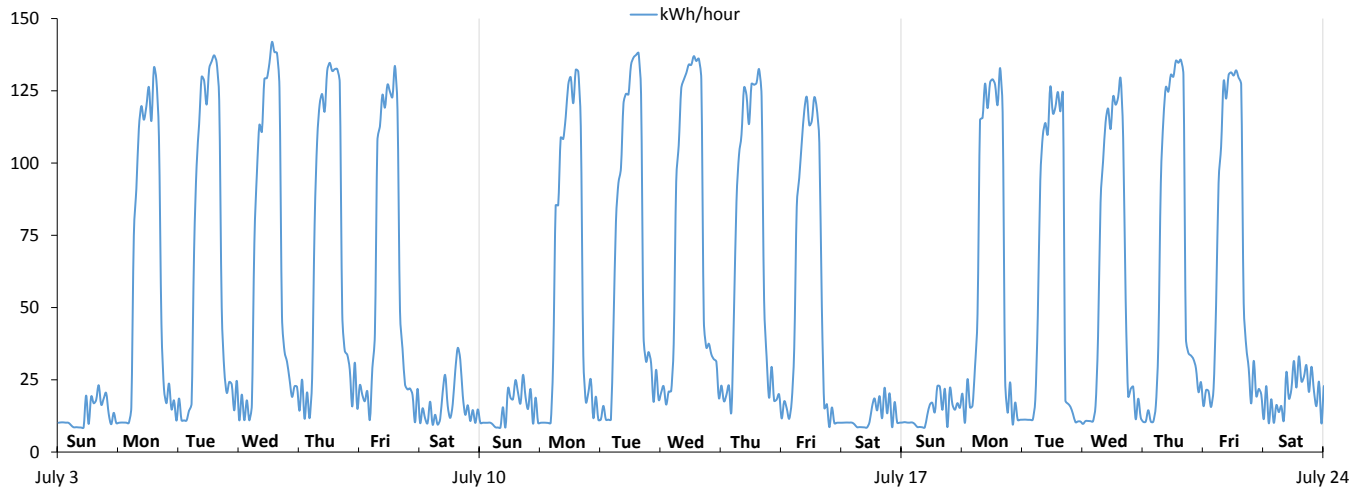
The Energy Pathfinder Research Initiative installed sub-meters at a CNC Machine shop to monitor the energy consumption of the following systems:

- Air Compressor (1 sub-meter)
- Air Make-up Unit (1 sub-meter)
- Office Air Conditioning (1 sub-meter)
- Lighting (1 sub-meter)

Energy Analysis

As shown in Exhibit 1, the main driver of electricity consumption for this machining plant is the operating hours. However, it can also be observed that a few overhead loads combine to produce a continuous load of 10-25 kW during non-operating hours. Further analysis of the plant's energy consumption showed that energy savings can be realized by eliminating the overhead loads associated with compressed air, ventilation, and air conditioning. These energy saving opportunities are discussed in further detail below.

Exhibit 1 Overall Plant Consumption Profile (kWh/hour)

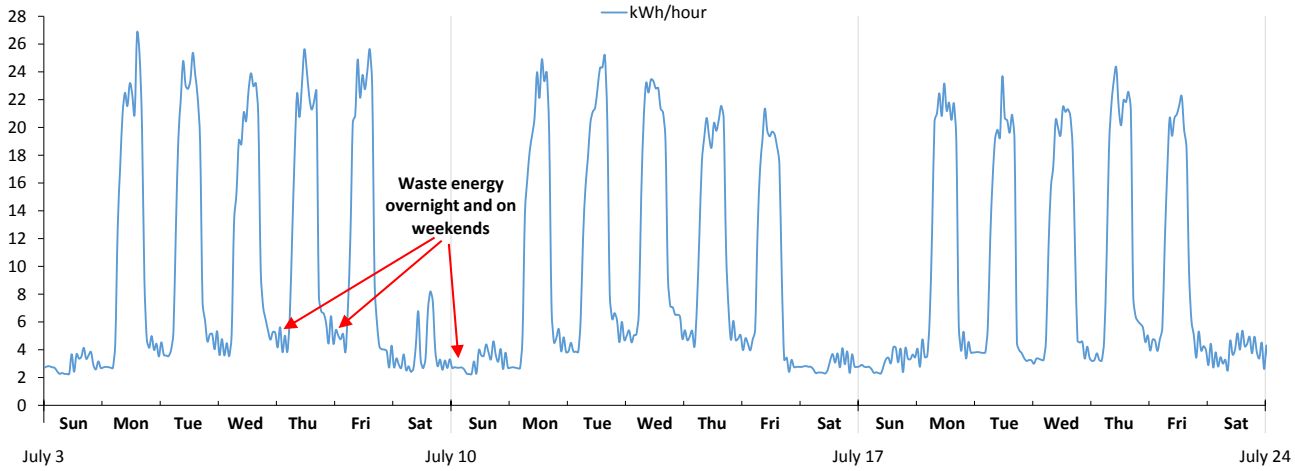


Opportunities for Energy Cost Reduction

Air Compressor Overhead Load

The air compressor has a variable speed drive that follows the daily load very effectively. However, as shown in Exhibit 2, the compressor continues to consume energy at night and during weekends when the shop is closed. This dead load can be avoided by shutting off the compressor during non-operating hours. It is known that the shop foreman or designate currently has a checklist of tasks to ensure the security of the shop before leaving at the end of the day. Adding the shut-down of the compressor to this list is a no-cost control opportunity that would eliminate this dead load and save the shop $3,900 annually.

Exhibit 2 Air Compressor Overhead Load (kWh/hour)

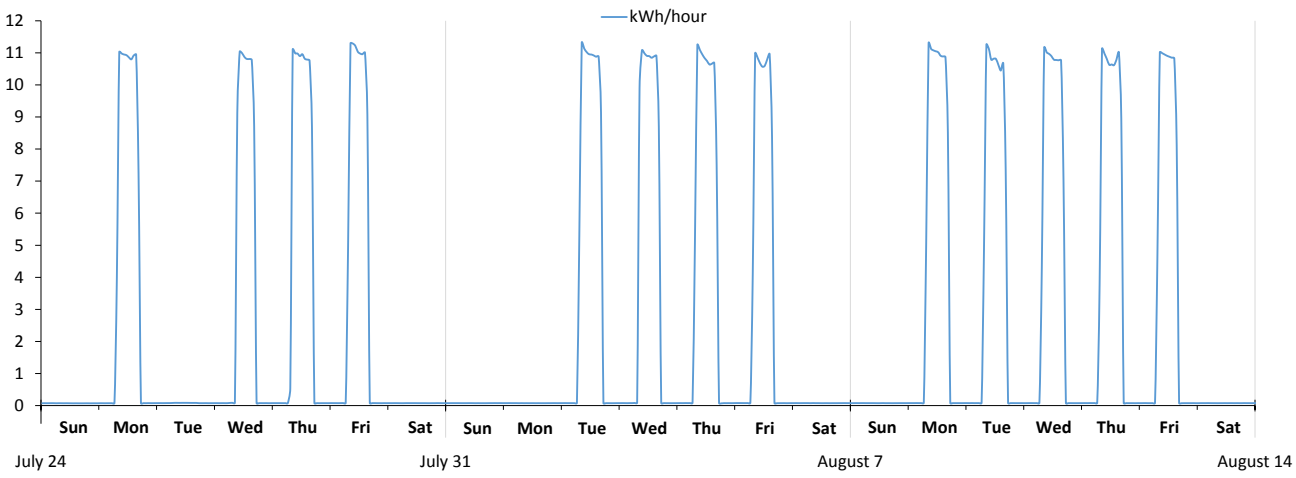


Air Make-up Unit Seasonal Load

The air make-up unit supplies fresh make-up air when the paint booth fan is running. During the winter this air is tempered by a gas heater, and in the summer the fan is used without the heater. Furthermore, the bay doors to the plant are open to help cool the employees on summer days. In these instances, the air make-up unit does not need to operate as fresh air is already being drawn freely into the building. By shutting down this fan during summer months the overhead load can be reduced.

Exhibit 3 shows the running load of the air make-up unit during summer days. Note that the fan does not run on days that the paint shop fan does not run as they are interlocked on/off controls.

Exhibit 3 Air Make-up Unit Seasonal Load (kWh/hour)



Air Conditioning Overhead Load

The facility's air conditioned spaces include offices and the lunch room. The natural drivers for the cooling of these spaces include occupancy hours and the outside air temperature. However, Exhibit 4 shows that the demand for air conditioning follows the outside temperature throughout the entire week, which suggests that the air conditioning runs continuously, even when the offices are closed at night and on the weekend. A better strategy to save energy would be to shut down the air conditioning system during unoccupied hours. Programmable thermostats could be installed to automate this function, thereby relieving staff from having to adjust settings each day. The air conditioning units would be started an hour before the staff arrive and shut off at the end of each day.

Exhibit 4 Air Conditioning Demand (kWh/hour vs. Temperature)

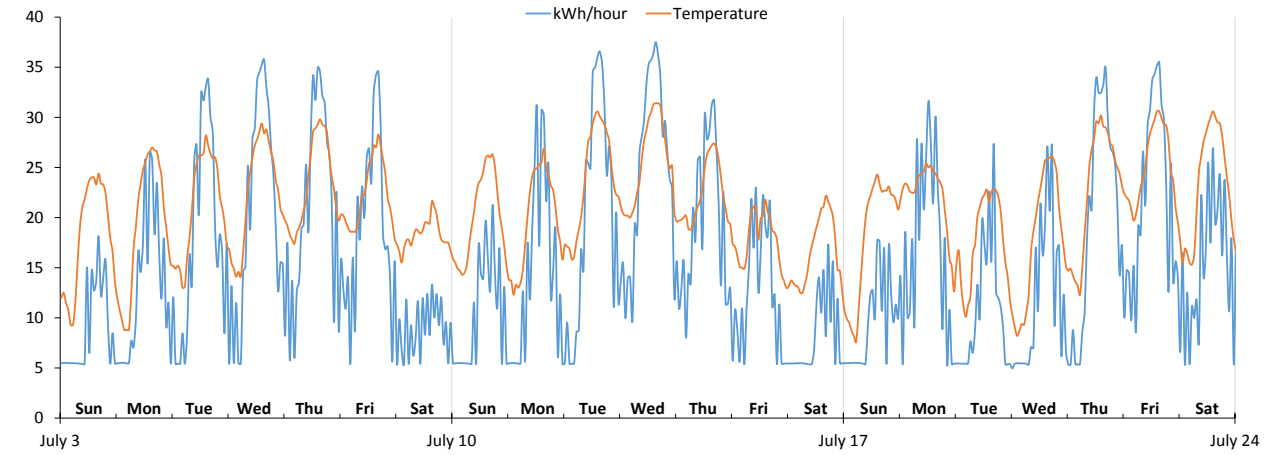


Exhibit 5 Summary of Energy Saving Opportunities

Opportunity	Capital Costs	Energy Savings (kWh/year)	Annual Energy Cost Reduction	Payback (years)
Eliminate air compressor overhead load	0	17,700	$3,900	-
Turn off air make-up unit when doors are open	0	8,000	$1,760	-
Turn off air conditioning on evenings/weekends	$500	18,900	$4,150	0.1

How many energy efficiency best practices has your facility adopted?

Find out by downloading and completing the CME Pathfinder benchmarking survey (by clicking here). This Excel-based survey covers important best practices associated with process heating, process cooling, machine drives, HVAC systems, lighting, and compressed air. Completing the survey will provide your facility with insights into where it can focus its future efforts to improve energy efficiency.

CME Energy Pathfinder Research Initiative

The Energy Pathfinder Research Initiative is designed to explore, define, and quantify low cost opportunities to improve, control, or optimize specific end uses and energy intensive processes for selected industries within the Ontario industrial and manufacturing sector. The project is unique in that it ***focused on the identification of operational opportunities rather than upgrading inefficient assets*** and aims to identify new best practises for waste energy reduction, realigning energy consumption to correct drivers, and identifying opportunities for load shifting or shedding for lowering peak demand and demand response.

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