BEST PRACTICE ENERGY

CASE STUDY 04

MILLENNIUM PLASTICS

Implementing Energy Efficiency

Since having an energy audit in 2009, Hamilton injection moulding company **Millennium Plastics, have shaved 15% off their annual electricity costs** by implementing energy efficiency initiatives.

The energy audit of Millennium Plastics was delivered as part of the Plastics New Zealand Best Practice Energy Programme. This programme has provided energy audits of more than 39 plastics manufacturers throughout New Zealand, identifying **over $1.5 million worth of energy savings**.

Millennium Plastics provides leading-edge plastic engineering technology and services to industries across Australasia.

Established in 2000, they are based in Hamilton, New Zealand. Their purpose-built facility is set up for high precision injection moulding and manufacturing.

Millennium Plastics operate 18 Negri Bossi computerised m/c's with integrated robotics on each m/c. The plant has been designed to manufacture medical and pharmaceutical components, for applications in both animal and human health.

Millennium specialise in optically clear materials for use in sterile systems. In-house processes include hot air annealing, sonic welding, post-moulding operations, assembly and tooling refurbishment. **www.millenniumplastics.co.nz**

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ENERGY NZ

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Energy Audit: A Great Starting Point

An energy audit is an ideal way to begin reviewing energy use in an industrial facility. Energy audits have been run at 39 plastics facilities through the Plastics New Zealand Best Practice Energy Programme since 2007. On average, these audits have identified energy savings of 14% of company's annual energy spend, with well over half of these savings having a payback of less than 1 year.

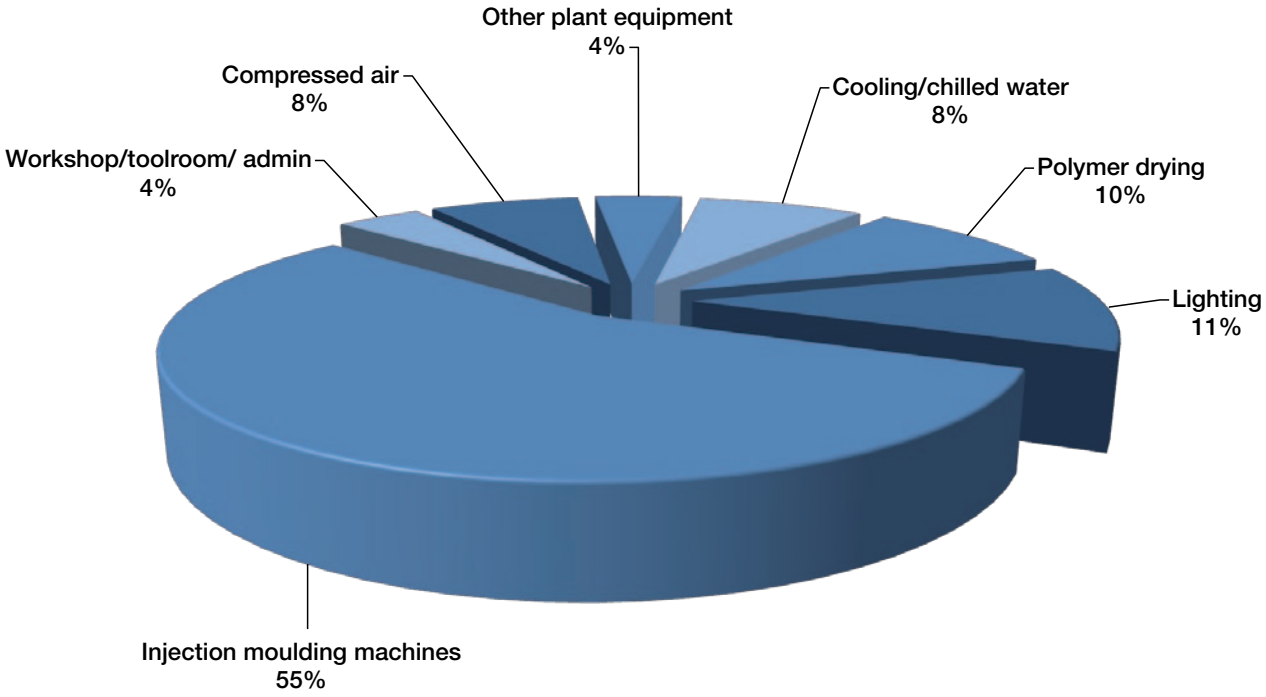
Millennium Plastics energy audit was conducted by Energy NZ Ltd. A team of engineers and electricians assessed the energy use of the entire plant to Level 3 of the ASNZ energy auditing standard. This meant Millennium Plastics were given a detailed breakdown of exactly where energy is being used in their plant.

Millennium Plastics spends between $130,000 and $150,000 a year on electricity. The auditors from Energy NZ identified 14 opportunities to reduce energy use at the Millennium Plastics site with a combined potential saving of more than $25,000.

The main opportunities included:

- Repair compressed air leaks
- Install timers on airconditioning units
- Optimise cooling water systems
- Insulate injection moulding machine barrels
- Change the lighting throughout the plant

Average energy use footprint for 11 audited NZ injection moulders



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Compressed Air

Millennium Plastics uses 9% of their total electricity for compressed air. Compressed air is a notoriously inefficient use of energy and should always be targeted for improvement. See also *Plastics New Zealand Best Practice Energy Case Study 01 – Compressed Air*.

Repair Leaks

Leaks commonly account for between 20% and 50% of compressed air use in a plastics plant. Fixing leaks is often a simple maintenance measure such as tightening a connector or replacing a fitting.

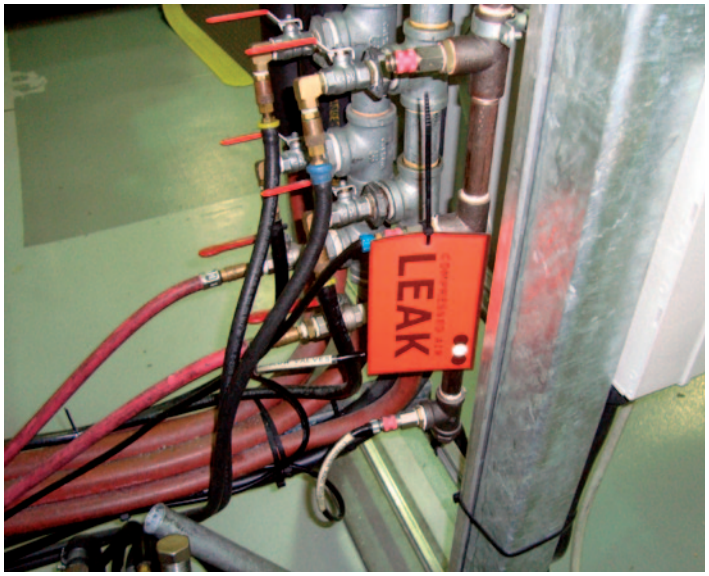
Millennium Plastics run an 11kW Kaeser rotary screw compressor delivering 150m3 per hour. 16 air leaks were found throughout the plant using ultrasonic leak detection equipment in the audit. These leaks accounted for around 50% of total compressed air use and were costing **$4,500 a year** in wasted energy.

TIP: Run your compressor on a non-production day and listen for air leaks. Identifying audible leaks will at least allow you to fix the worst, and most costly, leaks on site.

For smaller leaks, or to identify leaks in a 24/7 operation, an ultrasonic leak detection survey is recommended.

One of the compressed air leaks identified and tagged at Millennium Plastics:

Date	15/10/2009
Machine/Location	Line #12
dB	72
Pressure (bar)	6.8
Compressed Air Leak Rate (m^3/h)	9.68
Annual Energy Loss (kWh)	4,750
Total Annual Energy Cost	$662
Estimated Cost to Repair	$20



Compressed Air System Optimisation

The Kaeser air compressor at Millennium was set up with a pressure tolerance of 0.8 bar, with an unload point of 7.5 bar and a reload point of 6.7 bar. These settings meant the compressor was loading and unloading more than necessary, wasting energy during the unload cycle. Millennium staff slowly lowered the reload point in order to give a pressure tolerance of 1.2 bar. These longer cycle times, coupled with a new pressure regulator on the receiver outlet, resulted in less unload energy being used on average. Some staff time and a $300 regulator is saving **$900 a year** in compressed air energy costs.

Lighting

Lighting can present some simple, yet significant, energy savings for manufacturing sites. Lighting at the Millennium Plastics site accounts for 14% of total site energy use. This is a fairly typical level for a plastics manufacturing site with some warehousing and offices. The energy audit identified potential to reduce lighting energy use by 30%.

Reduce Light Levels

A good starting point for lighting is to measure the lighting levels throughout a facility. This can be done with a lux meter and the results compared against the New Zealand lighting standard (AS/NZS 1680).

The lighting survey of Millennium Plastics found that light levels in the offices were between 800-1000 lux where the required lux is 320. This meant that for zero-cost some of the fluorescent lamps could be disconnected in the main office reducing energy use by 1,400 kWh and **$229 a year** in electricity costs.

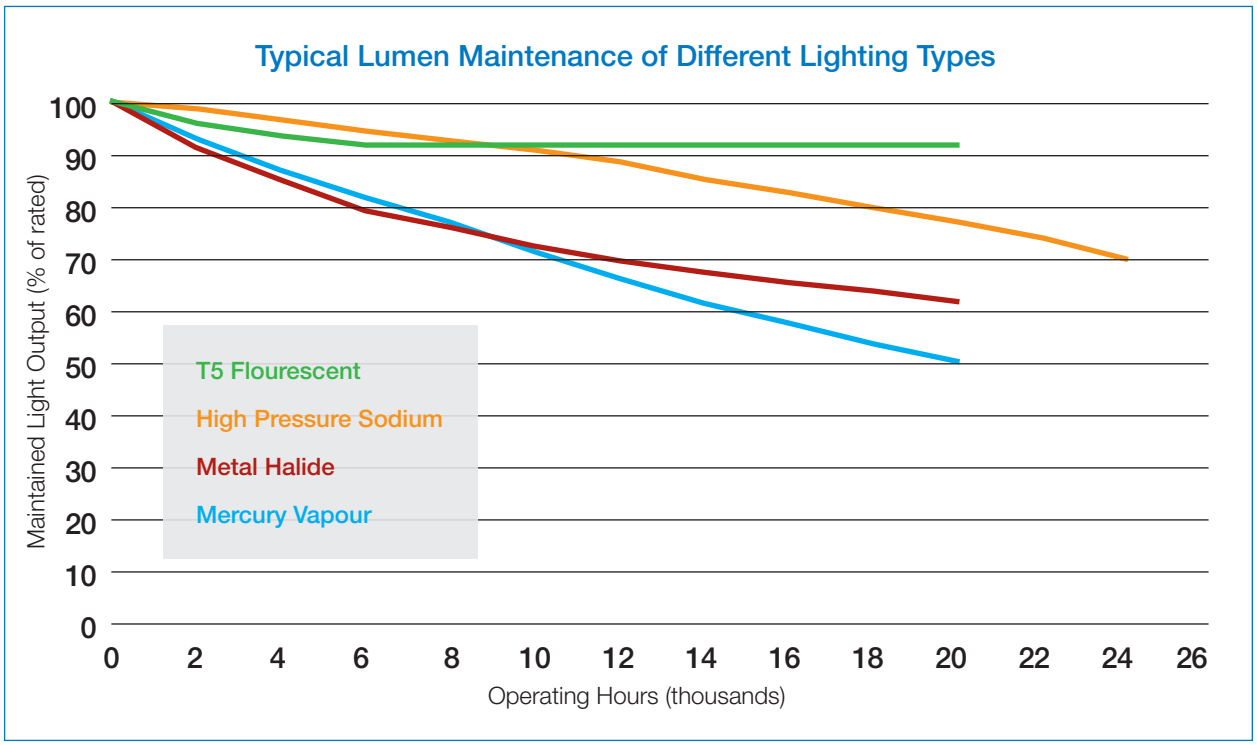
TIP: As lighting systems age, the light levels on desks and other working surfaces can drop by over 50%. Lamp output degrades and reflectors become dusty and dirty. Put in place a maintenance procedure for regular lamp replacement and cleaning of fittings. Better light quality means fewer lamps required.

Use More Efficient Lighting

Some lighting in the Millennium facility could be replaced with newer, more efficient lighting types. Forty metal halide lamps are used in the Millennium factory, each consuming 400 watts. Replacing these 40 high bay light fittings with new fluorescent 4-tube fittings that use just 216 watts per fitting would cost $17,600 and save **$5,776 per year**. Replacing these fittings would pay back in 3 years.

Number of Lamps / Fixtures	**40**
Operating Power Reduction	**6.88kW**
Annual operating hours	**6,000**
Annual kWh Saving	**41,280kWh**
Annual Energy Cost Saving	**$5,776**
Implementation Costs	**$17,600**
Payback Period	**3 Years**

New, fluorescent high bay lighting gives the added advantage of better light dispersion potentially reducing the total number of fittings required and reducing the investment cost. Fluorescent lamps have a similar life expectancy to metal halide lamps but their light quality does not degrade to the same extent. Fluorescent lamps also have no strike time meaning lighting controls become more viable.



Improve Lighting Control

There are often opportunities to reduce lighting energy use by putting in place better lighting controls such as motion sensors, lux sensors and timers.

The inwards goods store at Millennium Plastics has good levels of light (300 lux compared with the NZ standard of 160) and relatively low levels of occupancy. Auditors identified the potential to split the lighting circuit in two so that half the lights could be switched off during the day. To rewire the lighting would cost an estimated $1,200 and save **$525 a year** in energy.

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Chilled and Cooling Water

Chilled water and cooling water use 12% of the total energy consumed by the Millennium Plastics plant. This is fairly typical for an injection moulding plant. There are some common ways to reduce this portion of energy use. See also Plastics New Zealand Best Practice Energy Case Study 03 – Energy Efficient Water Cooling.

Cooling Tower Fan Control

Energy can be saved by controlling the fan on a cooling tower. Millennium Plastics has a 1.1kW fan running continuously on their cooling tower with no controls. This means that even during winter, when the water is much cooler than required, the cooling tower fan still runs. The solution was to install a temperature probe and switch unit to turn the fan off once temperature drops below a setpoint. This initiative cost $1,200 to install and is saving **$377 of energy costs each year.**

Reduce Cooling Water Pressure

The cooling water pump speed at Millennium is controlled using a pressure transducer that sends a pressure reference signal to the variable speed drive (VSD). This controls the cooling water pump speed. Using an electrical logging of the pump, the pump curve, and the speed of the pump at the VSD, it was estimated that the pumps were operating at 53m of pressure head. Reducing the systems pressure setpoint to 30m is a zero cost initiative delivering more than **$4,500 in annual energy savings.**

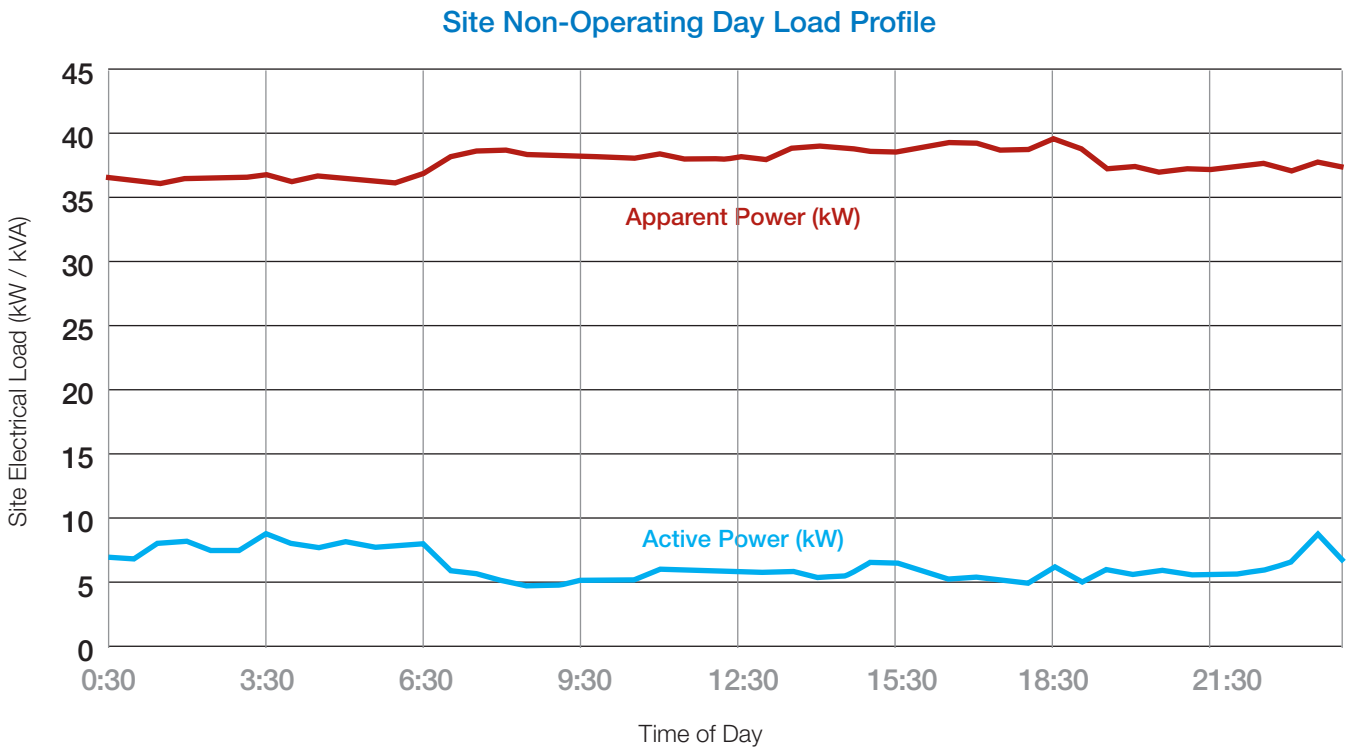
Control Evaporator Circulation Pump

The Millennium chiller compressor cycles on and off depending on the cooling load but the evaporator circulation pump was running continuously. Because the chiller's temperature probe was located in the evaporator circulation pipe it only measured the reservoir temperature accurately if the pump was running and water was flowing. Loggings found the chiller averaged 35% duty, meaning the pump was running unnecessarily 65% of the time and wasting energy. The solution was to move the chiller temperature probe to the chilled water reservoir and install a PLC to control the evaporator circulation pump. The pump now only runs when the chiller is running. The result is an energy saving of **$989 per annum** for a total installation cost of $1,400.

Power Factor Correction

Power factor is frequently found to be a problem at plastics manufacturing sites because power factor correction units have failed or have not been set up correctly. Incorrectly operating power factor correction can result in significant penalty charges being imposed by your electricity company. The Millennium Plastics audit found that on a non-operating day the plant had a base load with an unusually high level of apparent power relative to active power, indicating a poor power factor (see graph below). This was resulting in unnecessary penalties being imposed by the lines company.

Millennium Plastics investigated the cause of this unusual load profile and found that a contactor in one bank of capacitors in the power factor correction unit was faulty. The contactor was repaired at a small cost and is saving Millennium more than $2,200 a year in electricity penalties.



TIP: Power factor correction faults can be very expensive if they go unnoticed. Undertake annual inspections of power factor correction systems, or contract a specialist to provide this service.

If peak demand charges in your area are high, you could install a simple alarm system to ensure that you are quickly made aware of power factor correction failures.

The Result

Millennium Plastics have implemented more than two-thirds of the energy saving initiatives identified by the energy audit. They are now saving around **$17,000 per annum** in electricity costs for an investment of just $5,000 in site changes (excluding the cost of the energy audit).

Energy Reduction Initiative	Energy Reduction (kWh)	Annual Cost Savings	Total Project Cost	Payback Period	Status
Remove or disconnect the fluorescent tubes in the office	1,400	$229	$0	N / A	Completed
Instruct all staff to turn off PCs off when going home or leaving them unattended for more than one hour	2,799	$329	$0	N / A	Completed
Trial reducing the cooling water system pressure set point	32,333	$4,524	$0		Completed
Repair air leaks in the plant air network	32,674	$4,550	$530	1 month	Completed
Trial and implement a higher compressed air pressure setpoint tolerance of 1.2 bar with a load point of 6.7 bar and unload point of 7.9 bar	6,677	$930	$300	4 months	Completed
Install switchboard mounted timers for the air conditioning units so that they are automatically turned off overnight	23,625	$2,785	$1,500	6 months	Completed
Install insulation on the injection moulder extruder barrels	19,453	$2,902	$3,122	1.1 years	Being considered
Change the position of the chiller unit's temperature sensor to the water reservoir, install a timer on the pump's contactor and a failsafe for the compressor to ensure the pump is also running when it runs	6,540	$873	$1,200	1.4 years	Completed
Set up the chilled water system so it can utilise "free" cooling through the cooling tower during cold months	22,148	$2,722	$5,758	2.1 years	Being considered
Improve the control of lighting on the site	3,050	$525	$1,200	2.3 years	Being considered
Replace the existing lighting with the more efficient lighting types	41,280	$5,776	$17,600	3 years	Being considered
Install a temperature switch on the cooling tower fan	3,195	$337	$1,270	3.4 years	Completed
Investigate the causes of the poor site power factor.	0	$2,290			Completed

Best Practice Energy Programme

Plastics New Zealand is a national trade organisation representing over 200 member companies.

It is estimated that the New Zealand plastics industry consumes more than 1.7 petajoules of energy per annum.

The Plastics NZ Best Practice energy Programme helps plastic companies to minimise their energy footprint through energy audits and practical actions.

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