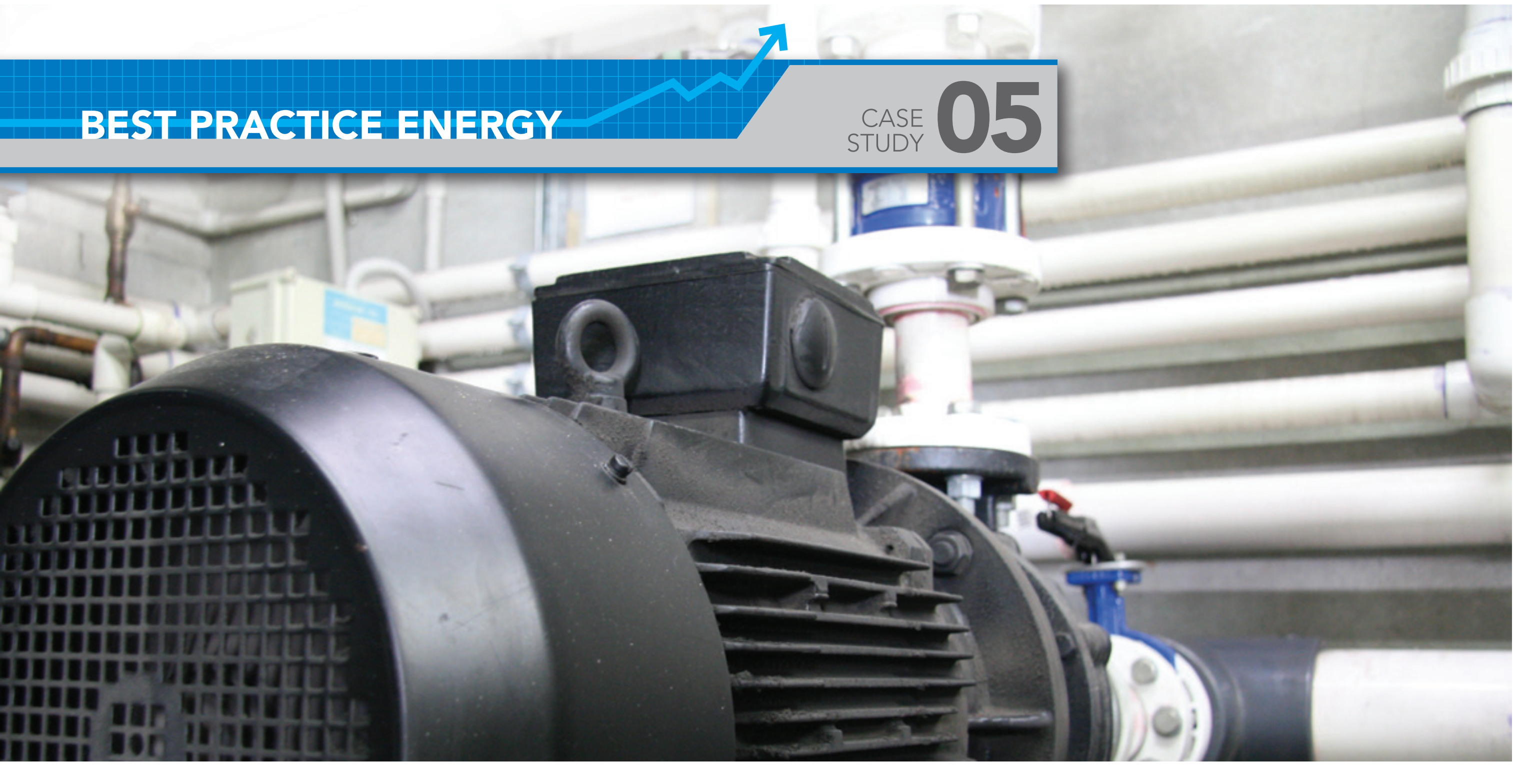

ENERGY EFFICIENCY FOR PUMPS

Pumps are used commonly in the plastics industry, primarily for the distribution of cooling water. Pumps can account for up to 10% of a plastics plant's energy use.

The energy and maintenance costs of a pump over time usually far outweigh the up-front capital cost. So it is important to set them up correctly. Using more efficient pumps in a more effective way, could save thousands of dollars in energy costs.

This Best Practice case study provides some simple tips and real examples of how to design and use pump systems more efficiently on your plastics site.

There are three key questions to ask when reviewing the efficiency of your site pumping system:

1. Is water being pumped unnecessarily?

Before reviewing the way your pumps are running, the first step should be to review the volumes of water you are pumping and whether those volumes are needed.

2. Are pumps appropriately specified?

Pumps are designed for specific functions. Some pumps are designed to operate with high head and low flow, while others are for low head and high flow. You should ensure you have the right pump for your needs.

3. Can pumps be more efficiently controlled?

There may be smart ways to control the pump when there are variable flows and demands.

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Maximising the growth and success of plastics-based technology in New Zealand in an economically, socially and environmentally responsible manner.

1. Eliminate unnecessary pumping

Inappropriate use of water, or unnecessary movement of water, translates into wasted energy consumption and cost.

The first step in reducing pump energy use should be to eliminate unnecessary uses of water around the site. A common opportunity found at plastics manufacturing sites is the circulation of cooling water to machines that are not in use. Many new machines have automated shut-off valves to stop this water circulating, but older machines have a manual valve. Using this valve to shut off water flow to idle machines should be written into a startup and shutdown procedure. Best practice is to automate the shut-off and link it to the operation of the machine. However, in some cases the energy savings from automation may not be sufficient to justify this cost, so it should be assessed on a case-by-case basis.

It should be noted that some companies keep water flowing through the machines to prevent stagnation in the moulds or out of concern that staff will not re-open valves before restarting the machines. However, these issues can be overcome by throttling valves, automating valve operation and putting in place robust procedures.

Shutting off circulation pump in winter saves $2,800 p.a.

An Auckland plastics company has a cooling water network that uses water from a cool tank which is pumped through the chiller and into a cold water tank. The chiller is currently being used for approximately five hours per day for five months of the year, and is left on standby the remainder of the time. The pump that circulates water through the chiller runs year-round to provide a reference water temperature for the chiller and because the pump needs to be primed to be restarted if it is switched off.

The company now switches the circulation pump off for the 7 coolest months of the year, saving **$2,800** in electricity costs every year.

Always try to take a holistic approach to your water distribution system in order to minimise pumping requirements. Often when a site grows over time, the infrastructure is simply added to with little consideration for how the changes will affect energy use or interact with existing services.

Isolating chilled water lines to unused injection moulding machines saves Tekplas $1,200 a year

Tekplas in Hamilton has 12 injection moulding machines with chilled water supplies. An energy audit found that chilled water was circulating to three of the machines even while they weren't operating. The company did not want to fully isolate the water flowing to the machines, but by reducing flow by throttling the chilled water inlet valve they could reduce pump power use by 1.36kW. This translates into an estimated **$1,200** of energy savings per year for zero cost .

Wherever possible, try to avoid the recirculation of water - for example, when water overflows are returned to cooling water reservoirs.

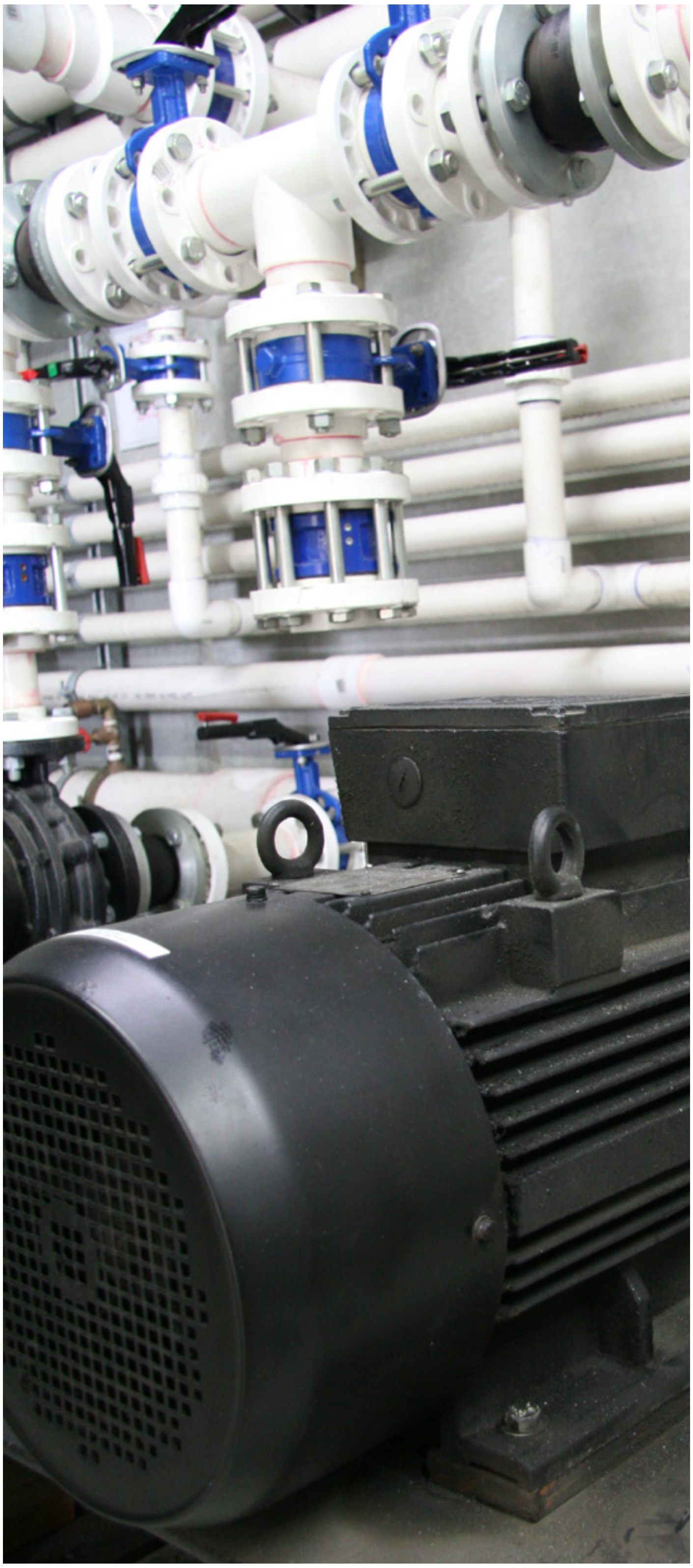
Audit finds $26,000 p.a. of unnecessary pumping

A large New Zealand plastic extrusion company operates a centralised chilled water system, supplying water throughout the plant at 10°C. The system has a main water reservoir supplying cooling water to the plant using three pumps. Water returns from the plant to a sump and is then returned to the main reservoir using two sump pumps. There is also a 'balance pipe' at the top of the water reservoir that allows water to overflow directly to the return sump when the water level is high.

An energy audit of the plant found that 115m3/hour of water was overflowing through the system balance pipe. This is water being unnecessarily pumped around the system, therefore wasting energy. The proposed solution is to install a variable speed drive (VSD) on each of the two sump pumps and reference it to the reservoir water level to keep water levels below the balance pipe, meaning only the water needed by the plant will be pumped.

Installing a 37kW VSD to control the two sump pumps will cost $8,500. A further $2,600 for an ultrasonic level sensor and $4,000 for installation brings total costs of the initiative to $15,100. Annual energy savings from the reduced pumping will be **$26,600**, giving simple payback of seven months.

2. Correct selection of pumps



The energy costs of a pump over its lifecycle far outweigh the upfront purchase costs, and can be as high as 85% of total pump lifecycle costs. It is therefore very important to consider energy use when purchasing and setting up your pumping system and associated controls.

Wrong sized pump costs injection moulder $18,484 a year in wasted electricity

An Auckland injection moulding company had a Southern Cross 37kW pump delivering 125m3/hr at 70psi to its chilled water line. An examination of the pump curve against the operating data for this particular pump found that it was running well outside its normal operating range. This meant the pump was using 41.1kW of power and was on the verge of cavitating.

The pump was replaced with a Grundfos with variable speed drive (VSD) motor, providing the same flow for just 22kW. The pump cost $5,000 and the VSD $6,500 giving a total project cost of $11,500. This initiative has saved **$18,484 a year** ever since, paying for itself in just seven months.

Make sure you select a pump that is most suitable for the work it will be doing on your site. When selecting a pump you should determine the required flow and pressure to be generated by the pump. It is important to know as much about the pump system as possible and to create a pressure/flow profile for the system. The energy required to drive the pump is directly related to the flow and pressure required and therefore you need to match the pump with the system.

Older pumps can be inefficient. Investing in new, replacement pumps that are designed to suit the specific application, and have new motors that conform to minimum energy performance standards (MEPS), can give a very attractive payback.

3. Efficient pump control

In situations where pump loads vary, the use of more efficient controls can give good energy savings.

Traditionally, throttling with valves has been used to regulate flow in a pumping system. While throttling reduces the flow, the motor is still running at full speed and must work even harder, as it has to work against an added restriction.

Variable speed drives (VSDs) are an increasingly common technology used to overcome this inefficiency. VSDs are used to match the speed of a motor with a variable load. In a centrifugal pump, the power consumed is proportional to the cube of the motor speed, while the flow rate varies in direct proportion to the speed of the pump. This means that if the motor speed, and therefore the flow rate, is reduced by half, the power consumed is reduced to one-eighth. This is why VSDs have considerable potential to save energy in pumping systems.

VSD on cooling water pump gives payback in 2.2 years

An Auckland plastics plant has a centralised cooling water system feeding eight extruder lines. Water is pumped into the plant by an 18.5kW pump and returned via a series of sumps with level-controlled pumps. Energy auditors identified the potential to isolate cooling water supply to machines that are not operating and at the same time control pressure using a VSD retrofitted to the supply pump.

Costs for this initiative include $7,139 for a VSD, pressure transducer and installation, and $4,000 for new ball valves allowing machine isolation, giving a total cost of $11,139. Potential energy savings are **$5,000 per annum**, giving a simple payback of 2.2 years.

Pumping requirements vary from site to site. Wherever possible, you should get expert advice to assess your pumping system needs and to select the right pumps for your site. Pumps are thoroughly assessed as part of detailed energy audits offered through the Plastics New Zealand Best Practice Energy Programme. Contact Plastics New Zealand to find out more.

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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