

Reducing Energy Costs - Understanding Usage and Changing the Rules

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Introduction

Rising energy costs are a worldwide concern and companies around the world are complaining about these and the effect on their profitability. Despite this, most companies have failed to carry out even the most basic actions to reduce their energy consumption. It appears that many would rather 'talk the talk' than 'walk the walk'.

There are two ways to reduce the cost of energy:

- * Reduce the amount paid for the energy (the Bahts or cents per kWh approach).
- * Reduce the amount of energy used in the factory and the process (the kWh per kg approach).

The second approach is more productive because a kW saved is a total saving whereas a kW at a reduced price is only a partial saving.

Energy is not fixed and uncontrollable overhead cost, it is a variable and controllable cost. Most plastics processors can reduce energy usage by up to 30% and increase profits by up to 3% through simple management action, maintenance action and intelligent investment. Instead of complaining about things that are mostly beyond your control why don't you actually take actions that are within your control to reduce costs?

**Energy is a variable
and a controllable cost**

The essential questions

Before you can start to reduce your energy usage you need to understand where, when and why you are using energy.

Where you are using energy?

The main electrical energy users in plastics processing are motors and drives, heaters, cooling systems and lighting. A simple site energy distribution map will show where energy is being used. This is generally easily prepared by the site

electrician. If you are using a single meter it may be cost effective to use sub-meters to get further information on the areas of high-energy use. Sub-metering allows you to start to calculate the cost of energy for each operation and to identify areas of high-energy usage – a key factor in reducing energy costs. Producing an 'energy map' of your site will allow you to locate areas for monitoring and possible improvement. Don't forget to include compressors and chillers as these are often major energy users.

When you are using energy?

The time you use energy is important and a graph of demand versus time will give invaluable information on how to reduce the energy costs. Data for such a plot should be available from your supply company - look for unusual peak variations (spikes) and energy use during non-production periods (waste). These are potential areas for improvement.

Why you are using energy?

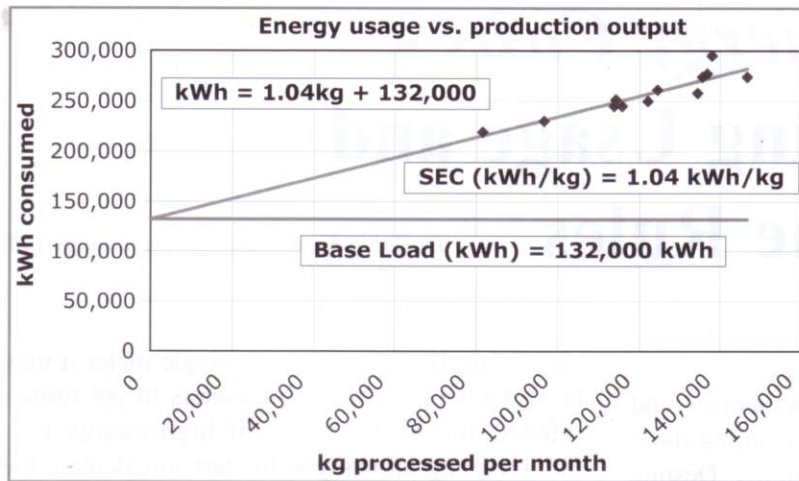
Energy use in plastics processing is a combination of two components:

$$\text{Total energy use} = (\text{Production volume} \times \text{SEC}) + \text{Base Load}$$

The SEC is the 'Specific Energy Consumption' and is a measure of the amount of energy used to process each kilogram of good finished product. This is an excellent benchmark figure to check competitiveness and to provide targets for improvement.

The *base load* is incurred irrespective of whether production is taking place or not – it does not change as output changes. This is the load used for heating, lighting, compressors and pumps when you have no production at all.

The best way to find the SEC and the base load is to record the meter readings (in kWh) and the related production volumes (in kg). Plot these (see Figure 1) and find the equation of the best-fit line. The SEC is the slope of the line and the base load is the intersection of the line with the vertical axis (the energy use at zero production).



Plot the usage against the amount of polymer processed to generate a graph similar to this (this is real data from an injection molder). The SEC is the slope of the graph. The base load is the intersection of the curve with the vertical axis.

Figure 1: Specific Energy Consumption (SEC) and the Base Load

There are two methods of reducing the total energy use:

Reduce the SEC to reduce the variable costs – this involves improving production efficiency and is something we should always be trying to do.

Reduce the base load to reduce the fixed costs – this mainly involves switching something off and is a sure way to make savings because the energy used is not production related. Some examples are: idling machines, heaters running with no production, compressors running with no production, lighting etc.

Simple

Simple actions such as starting to treat energy as a variable cost and understanding your usage will highlight areas for improvement. Energy management will save you money and make you more competitive but, as with any management, it does mean that you need to measure before you can start to manage. Start managing energy today by discovering the source of the costs, making the users responsible for them and giving them the authority to reduce them.

Changing the rules

Energy efficiency is not simply about turning out lights and adjusting the heating or air-conditioning. Energy efficiency is also about using cost-effective technology to permanently reduce a company's energy consumption. Changing the behavior of people to turn out lights needs them to be motivated and constantly encouraged. Changing the light switch for a movement or daylight detector is quick, low cost and effectively permanent. It is easier to change the rules than to change the people.

This is even more critical when investing in machinery and ancillaries (see Figure 2). It is easier and cheaper to purchase energy efficient equipment than buy the lowest cost machinery and to then pay continuously for the energy it uses. Purchasing energy efficient capital equipment will permanently change the rules for a company's energy efficiency. Energy efficient capital equipment will change the rules for a company.

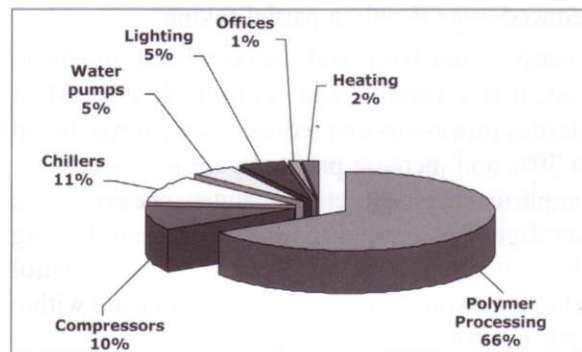


Figure 2: Typical Energy Use in Plastics Processing

The cost of the energy used during the lifetime of almost any piece of capital equipment will be more than the initial purchase cost. This is even truer for machines that are not energy efficient. Energy efficient machines save money in the long term - an important factor if customers expect price decreases through the lifetime of a product!

As with any capital equipment, the initial purchase cost should not dominate the decision-making process. The 'whole life' cost of the equipment (initial cost + operating costs) is the important cost for any plastics processor who wants to continue operating in the long term. For companies that use a simple 'payback' as the assessment criterion it is

important to look longer than the simple payback number. Look at cash flow over the equipment life to find products with the greatest benefit and don't forget to factor possible future energy price increases into the equation. An 'energy efficiency assessment' must be an essential part of the capital expenditure approval process, i.e. *No assessment of operational energy use = No capital expenditure approval.*

Typical Projects

When looking for 'energy efficiency projects it is important to look for projects where the rules can be changed and make energy saving automatic.

Improved energy efficient technology makes it possible to re-equip a factory for permanently lower operating costs.

Potential areas for investment include:

1. *Energy efficient motor selection.*
2. *All-electric injection molding machines.*
3. *Inverter controls for hydraulic injection mold-*

ing machines.

4. *Cooling water treatment using free cooling.*
5. *Polymer drying.*
6. *Lighting schemes and controls.*
7. *Compressors and controls.*

These are all projects where current technology has proven energy saving benefits. Typical projects have paybacks from under 3 years and often are as low as 9 months - low cost energy efficiency projects can change the rules and significantly improve profits.

You can change the rules to permanently reduce energy usage and it is much easier than you think. What is stopping you? 🙌

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