

Energy management in plastics
processing
Staff Training Course

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Company Profile

Tangram is a technology based consultancy dealing with the needs of the plastics processing and plastics building products industries.

Tangram provides high quality energy and environmental management, change management, technical writing, training, product design consultancy and field services for these diverse industries.

Our client base consists of some of the largest plastics processing companies in the world, PVC-U window systems designers, PVC-U window fabricators, specifiers, large contractors, hardware manufacturers and computer services companies. We carry out extensive work for the UK Government, the EC and other international institutions in a variety of fields.

Tangram is technology based consultancy, not a management consultancy. We supply the specialist technical knowledge needed by our client base.

Products and Services

Energy and Environmental Management

We survey and assess plastics processing factories for energy efficiency and provide detailed programmes for energy efficiency improvements. We manage the energy reduction process inside the factory. We develop, install and externally monitor Environmental Management Systems

Energy Management Surveys, Development and installation of Energy Management Systems, Development and installation of Environmental Management Systems, Training for Energy Managers.

Change Management

We develop and implement energy management systems and strategies, manufacturing strategies, quality systems and Health and Safety management systems to meet the requirements of the latest legislation. We can also provide project management services for similar large projects.

Manufacturing Strategy, Quality Management, Factory Layout, Health & Safety Management, Project Management.

Technical Writing

We develop technical literature to back-up or sell your products. These can be complex product manuals, specification guides or internal training information. All are designed to your needs and to a variety of formats from paper based to web pages.

Product Manuals & Technical Information, Specification Guides, Expert Systems, Public Relations & Article Generation, Quality Documentation Services, Web Site Generation and Management.

Product Design

We help to design and produce new products. At the forefront of product developments for 30 years we can help to get *your* product to market.

Product Design & Management.

Field Service

We carry out a truly independent review and assessment of your needs for new machinery or systems.

Health Checks, Customer Set-up & Service.

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The Workbook

Why are we doing this?

Tangram Technology works with many large plastics processing companies on energy management in their sites and one of the major blocks to progress is getting the staff involved in the process of energy management. One of our clients carried out a simple staff training process with all the staff at the site and the next month the energy usage decreased by 20%. A remarkable achievement for relatively little work and very little cost. Simply delivering a 60 minute training course reduced costs immediately and significantly.

Despite this, there are relatively few easily available resources in the area and we cannot be everywhere. We have developed this Workbook as a free resource and hope that it will be of some help to smaller processors who want to deliver a quick training course to their staff to start the journey towards energy management.

We are placing this training course in the public domain but all the contents remain the property of Tangram Technology Ltd.

Scope and Objectives

This Workbook is designed to allow trainers to carry out a structured training session of approximately 1 hour. The session covers the basics of energy management for all levels of staff in the plastics processing industry.

The Workbook provides internal or external trainers with all of the basic resources necessary to deliver a training session tailored to the plastics industry. The trainer should be either an internal trainer or an external professional trainer with a good knowledge of the sector.

The Workbook covers the reasons for energy management (both financial and environmental) and some of the basic steps to actually reduce energy consumption in plastics processing.

Session timings

This training session is designed to take approximately 1 hour to run. This does not include the energy 'walk-around' that should be carried out at the end of the training.

Changing the presentation

Trainers should feel free to modify the structure and content of the session to match the needs of the audience. The session covers all aspects of the industry and companies may want to modify the session to focus on their specific needs. Material that is not considered relevant may be deleted or additional material can be added to cover specific points that are felt to be particularly relevant.

Acknowledgements:

- I would like to thank Mr Joe Cork of LINPAC Packaging for providing some of the better ideas in this training workbook.
- The text and photographs are copyright Tangram Technology Ltd. ©2010.
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Hints and tips for the trainer

Before you start

1. Know your subject

The trainer should be familiar with the contents of this Workbook before they start the first training session. What a trainer talks about is only a fraction of what they know - the rest is held in reserve for questions and explanations. Read the complete Workbook and collect the necessary backup materials before running the first training session.

2. Keep up to date

The subject of energy efficiency is constantly changing. Keep up to date with the latest publications and information from trade magazines and other sources. New information is always useful to delegates and gives the trainer added credibility.

3. Know the audience

This Workbook is designed for a varied audience. The trainer should adjust to any specific bias or preference of the delegates. If the audience is management then the financial benefits need to be presented clearly, if the audience is from the shop floor then the savings in effort and extra work can be highlighted. Knowing the audience affects how the trainer presents the information to maximise the training benefit.

4. Make the content relevant

The contents of this Workbook are naturally generic in nature. If the training sessions are for a specific company then modify the content to be directly relevant. This will help to encourage energy efficiency in the company.

5. Control the venue

The right setting is essential to running a good training session. Make sure that there are no interruptions and that all the technical equipment (projectors and screens) work and can be seen by the delegates.

6. Get a flip chart ready

Some of the exercises and questions will provide information for further work by the trainees and the site. Record the answers for future reference.

Running the sessions

1. Tell them what you are going to tell them

Hints and tips for the trainer

Experienced trainers use the format:

- Tell them what you are going to tell them
- Tell them
- Tell them what you have told them.

Present the key points at the start and the end of the sessions.

2. Never read simply the slides

The format of this Workbook gives the trainer access to the contents of the slides. Do not be tempted to simply read out the slides and move on. The trainer's page gives further information - Use this to expand on the contents of the slides and add value to the time the delegates are in the sessions.

3. Be yourself

There are many rules for good training sessions and good trainers break them all the time. The best advice is to be natural. Delegates do not expect to see a different person in the training room to the one they see every day. Training is to convey knowledge not an opportunity for amateur dramatics. Relax, nobody is trying to trick the trainer.

4. Be flexible

As the session is run there will be times when you may need to alter the sequence of the material or even split up the material into shorter sessions. This is allowed, the session is planned to get the maximum amount of information across to the delegates. As a trainer you can be flexible in how you present the information.

Decide in advance if you want questions during the session or at the end. A flexible small group session is probably best run with questions during the session. The trainer's page provides some questions that may be asked and some typical answers, but do not let questions distract the session and be prepared to stop the discussion if it goes on too long.

5. Starting and finishing

Delegates will lose concentration during the session. Get the important summary information across in the first 4-5 minutes before the delegates lose their concentration. Keep the presentation sessions concise and break up the sessions to allow the delegates to regain concentration.

Further Information:

Energy Management in Plastics Processing: Strategies, targets, techniques and tools, Elsevier (www.elsevier.com), ISBN: 0081025076.



Energy management in plastics processing

The trainer should introduce the session.

This training session has been designed and developed for the plastics processing industry by Tangram Technology Ltd.

The trainer should introduce the aims of the session:

- The training session is designed to provide a complete training session for all levels of staff on the basics of energy efficiency and the benefits to the staff and the company.
- The trainer should note that this is not a single training session but the start of an ongoing policy:

This session will be run throughout the business to raise awareness and motivation levels of all staff.

Energy management in plastics processing

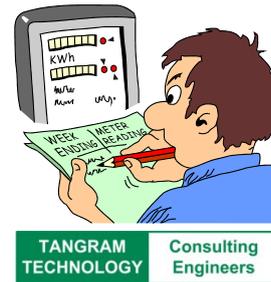
Why worry about energy?

The carrots

- Finance
- Management
- Environment
- Customers

The sticks

- Legislation
- Our reputation



Why worry about energy?

Using energy in plastics processing affects a company on many levels and there are many reasons for being concerned about energy use.

There are several 'carrots' (good things that happen if the company reduces energy use) as well as several 'sticks' (bad things that happen if the company doesn't reduce energy use).

All of these should be familiar to the delegates but we will discuss each of the 'carrots' and 'sticks' in detail.

- **Trainer Tip:** This is simply to introduce the reasons for starting to manage energy use. Each reason is discussed in detail on a later slide.

Energy management in plastics processing

The carrots - Finance

- Energy costs are much the same as the cost of direct labour
- Energy is now the second or third largest cost and the fastest rising cost
- Reducing energy costs makes the company more profitable
- Reducing costs protects jobs



The carrots - Finance

The cost of energy for most plastics processing companies is in the region of 3-8% of the production costs and for most companies exceeds the profit.

- **Trainer Tip:** The actual figures should be easily available from the Accounts Department for most companies.

For most plastics processors in the developed world the cost of energy is the third largest cost after materials and direct labour.

For many plastics processors in the developing world the cost of energy is the second largest cost after materials because of the generally lower direct labour costs.

The cost of energy is also one of the fastest rising costs for plastics processors and it is rising much faster than labour costs in almost all of the world.

- **Trainer Tip:** All trainees will be aware of the rising cost of energy in their homes. Energy is now a significant cost to most people.

Most companies have already tried to reduce labour costs but very few have tried to reduce energy costs.

Reducing energy costs will make the company more profitable and make it more likely that the company will survive and continue to provide jobs.

Reducing energy costs is a very practical and profitable alternative to trying to continue to reduce labour costs.

- **Trainer Tip:** Keep the direct labour, sack the kWh.

Energy management in plastics processing

The carrots - Management

- **Managing costs is good management**
- **Energy supplies are not certain and secure:
We must plan for the worst**
- **Other companies are already ahead of us:
competitive companies survive**



The carrots - Management

Good management

Managing costs of any type is simply good management and we should be doing this all the time. Companies that waste money do not stay in business or protect worker's jobs.

Energy supplies

The days of plentiful energy supplies are gone. Most of the main manufacturing countries have to import fuels to produce energy. This means that they depend on other, possibly less stable, countries for the energy that enables them to survive. Even when the producer is stable, the fuels must often be transported through pipelines or by sea through areas that are often less than stable.

Depending on other countries for your economic stability is not a recipe for success. Many countries are now trying to use 'sustainable' energy to reduce their energy dependence.

Competition

All companies have competitors who are ready to take business away from them by being more efficient. The competitors are already improving their energy performance to reduce costs. If we stand still they will overtake us and take our customers. Without customers we will not have a business or jobs.

- **Trainer Tip:** Many companies in the developing world are already trying hard to reduce their energy costs because they are a very visible cost and some of the most energy efficient plastics processors are in the developing world. They already have an advantage in the cost of direct labour and are now establishing an advantage in energy usage.

Energy management in plastics processing

The carrots - Environment

- Climate change
- Global warming
- Greenhouse effect
- Sustainability
- Life-cycle analysis
- Carbon footprint - using energy efficiently will help to reduce our carbon footprint



The carrots - Environment

Saving energy is not simply about our company and our jobs. It is about things that are even bigger than that:

- Saving energy is about reducing the environmental impact of energy usage.
- Saving energy is about reducing the company's contribution to climate change and global warming.
- Saving energy is about protecting the world's energy resources for future generations.
- Saving energy is about 'sustainable development'.
- Saving energy is about reducing the company's 'Carbon Footprint'.

Saving money is a way to attract the attention of the company but everybody benefits in the long-term.

- **Trainer Tip:** If anybody doubts the reality of this increased concern for the environment then they simply have to ask their children. Everybody knows that their children would not like it if their company was wasting energy or resources.
- **Trainer Tip:** Energy generation in the large amounts needed for our society is having an effect on the environment and we are starting to see these effects.
- **Trainer Tip:** The aim of this section is not to start a long discussion on the environment, it is simply to show that our activities can have more than local effects.

Energy management in plastics processing

The carrots - Customers

- Our customers care about our environmental performance because their customers care
- Consumer pressure - The questions are only beginning



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The carrots - Customers

Customers (and their customers) are people too and they care about the environment as much as we do.

- **Trainer Tip:** Would you buy from a 'dirty' company whose environmental performance was very questionable?

Many plastics products are incorporated into other 'final' products, i.e. packaging is part of the 'food' product. End-users and consumers are now demanding a reduction in the use of packaging because they see it (sometimes wrongly) as an environmental burden. Similarly various governments around the world are applying bans or restrictions on the use of plastics bags as part of their 'green agenda'.

- **Trainer Tip:** Much of the criticism of plastic bags is actually about litter and not the actual environmental credentials of the plastic bag itself.

Consumer pressure is already starting to affect retail suppliers and large retail companies such as Walmart are already starting to assess suppliers on the basis of their environmental performance.

This is a growing trend and companies that are seen as 'green' are establishing a larger market presence.

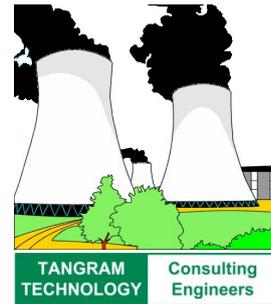
This type of customer pressure affects not only our sales but also our reputation.

- **Trainer Tip:** Without customers we will not survive but nobody ever said that survival was guaranteed.

Energy management in plastics processing

The sticks - Legislation

- Legislation is getting tougher and more complex
- Corporate social responsibility
- Stakeholders



The sticks - Legislation

Legislation

Wherever a company operates there is an increasing amount of legislation to be met. This is a government's reaction to increasing energy use and is being used to force large energy users into reducing the amount of energy they use.

There are a variety of schemes around the world but all have the same aim - to force energy users to reduce the amount they use. The names vary but the end-result is always the same: Use less or we will penalise you.

- **Trainer Tip:** Find out the name of the local scheme. In the UK there are a variety of schemes depending on the industry sector. For the plastics industry there is the Climate Change Levy (CCL), the Climate Change Agreement (CCA) and the Carbon Reduction Commitment CRC).

Corporate Social Responsibility (CSR)

CSR is a new idea and many forward-looking companies have joined projects such as the Carbon Disclosure Project to actively report their carbon emissions (mainly from energy use) and to actively reduce these.

Stakeholders

Many companies are also reporting their environmental and energy performance in their annual reports to shareholders and other stakeholders in the company.

Energy management in plastics processing

The sticks - Reputation

- A company's reputation can depend on its environmental performance
- Do you want to work for a 'dirty' company?
- Do you want to tell your children about it?
- Do you want to do something about it?



The sticks - Reputation

A company's reputation as a supplier can depend on its environmental performance. Community activists can easily use the Internet and social networking tools to damage a company's reputation beyond salvation and affect the security of the company and the jobs of the employees.

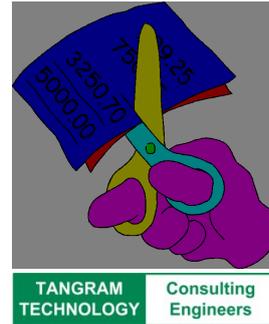
The easiest way to measure this is to ask the simple questions:

- Do you want to work for a 'dirty' company?
- Do you want to tell your children about it?
- Do you want to do something about it?

Energy management in plastics processing

Why are we doing this?

- The aim is to reduce energy use:
 - To retain customers
 - To save money and increase profits
 - To protect our jobs!
 - To play our part in protecting the environment by reducing our greenhouse gas emissions
- It is that simple



Why are we doing this?

- To retain customers
- To save money and increase profits
- To protect our jobs!
- To play our part in the protecting the environment by reducing our greenhouse gas emissions

It is really that simple!

Energy management in plastics processing

Who is involved?

- It is our problem and we are all involved but only if we want to have jobs in the future
- You are the 'front-line troops'



Who is involved?

This is not a simply a management and cost issue, it is an issue that benefits everybody.

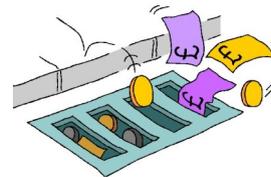
It is not simply a management problem, it is 'our' problem and everybody is involved.

- **Trainer Tip:** This is a team effort and we all need to contribute something because we will all benefit from the effort.

Energy management in plastics processing

What can we achieve?

- **Energy costs can be reduced by up to 30%:**
 - **Management - 10%**
 - **Maintenance - 10%**
 - **Technology - 10%**
- **We are ready to 'walk the walk' instead of simply 'talking the talk'?**



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What can we achieve?

Experience has shown that companies that have not started the energy management journey can save around 30% of the cost of energy in a period of 2 to 3 years for relatively little cost. This means that around 30% of the energy use in many companies is 'discretionary' - it is only being used because people couldn't be bothered to save it.

- **Trainer Tip:** This is money going down the drain. The aim of this initiative is to reduce energy use. This benefits everybody.
- **Trainer Tip:** Try to put a 30% saving into terms of continued profitability and survival of the company and their job security.
- **Trainer Tip:** Relate a 30% saving in energy costs to the amount of sales that must be made to produce the same profit and security. Energy savings are totally internal but sales must be competed for in the market. Energy cost savings can be used to lower prices, increase orders and produce growth and extra job security. Put sales into perspective in terms of the costs necessary to generate them!
- **Trainer Tip:** We must use energy to do our jobs BUT we do not have to waste energy to do our jobs!

Energy management in plastics processing

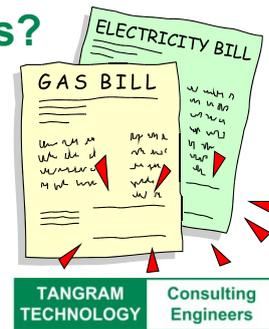
What are the current costs?

- Each year we spend:
 - £XXX,XXX on electricity
 - £XXX,XXX on gas

What are the potential savings?

- £YYY,YYY for electricity
- £YYY,YYY for gas

These are big numbers



What are the current costs?

The actual cost of energy to the company will shock most people. They have probably never seen these figures before and have probably never thought about them. Actually very few people will have seen them at all.

- **Trainer Tip:** The actual figures should be easily available from the Accounts Department for most companies. Modify the slide to show the actual values.
- **Trainer Tip:** Some companies will be reluctant to include financial information but there is a real need to tell employees of the amounts that are currently being spent and the amounts that need to be saved.
- **Trainer Tip:** If the efforts in improving energy efficiency are to mean anything it is necessary to start to quantify the costs and the potential gains in money terms.

The potential savings at 30% are large numbers and could easily transform how we do business as well as making us a 'cleaner, greener and meaner' company.

Energy management in plastics processing

What are our current CO₂ emissions?

- Each year we generate:
 - XXX,XXX tons of CO₂ from electricity use
(1000 kWh of electricity generates 0.537 tonnes of CO₂)
 - XXX,XXX tons of CO₂ from gas use
(1000 kWh of gas generates 0.190 tonnes of CO₂)



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What are our current CO₂ emissions?

As with the cost of energy, these numbers will shock most people. They have probably never seen these figures before and have probably never thought about them.

- **Trainer Tip:** Use the conversion factors to convert the energy use values (generally given on the bill in kWh) to the amount of CO₂. The conversion factor given in the slide for electricity is for the UK only. Different conversion factors should be used for other countries because the factors depends on the country-specific method of generating electricity, i.e. for countries with a lot of nuclear or hydro-electric power generation the conversion factor will be smaller and for countries with a lot of coal power generation then the conversion factor will be larger. Conversion factors are relatively easily available form suppliers or published data.

The total CO₂ emissions of a site and the activities are sometimes called 'The Carbon Footprint'. The CO₂ emissions given here are not the total CO₂ emissions, they are only part of the calculation but for most plastics processing companies will represent about 95% of the total CO₂ emissions.

Reducing our energy use by 30% would also reduce our CO₂ emissions by about 30%.

- **Trainer Tip:** This is a major reduction in CO₂ emissions considering that the average household CO₂ emissions in the Uk is in the region of 6 - 10 tonnes/ year and the USA it is in the region of 20 tonnes/year.

Energy management in plastics processing

Exercise: If we wanted to create an energy inefficient site then what would we do?



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Exercise: If we wanted to create an energy inefficient site then what would we do?

This is a simple exercise to provide a break for the trainees and to get them thinking. Get them to make suggestions about the things they would do if they wanted to create an energy inefficient site.

- **Trainer Tip:** Try to get about 10 different suggestions from the complete group and write them down on a flip chart as they are proposed.

You will find that the same things come up from most people:

- Lights
- Motors
- Heaters
- Compressed air
- etc.

Their focus will naturally be on what is within their experience. Do not discourage this. The idea is to get some suggestions before the training session.

Energy management in plastics processing

How many of these things are we doing today?

What controls are in place to stop us doing them tomorrow?

How many of these things would you do in your own house?

What is different?



What are we doing - controls and personal responsibility

Once you have the list of suggestion for an energy inefficient site' then ask the following:

- How many of these things are we doing today?

The probable answer is 'Most of them otherwise we wouldn't have thought of them'.

- What controls do we have in place to stop us doing them tomorrow?

The probable answer is 'None'.

- How many of these things would you do in your own house?

The probable answer is 'None, because it is my money that is being spent'.

- What is different?

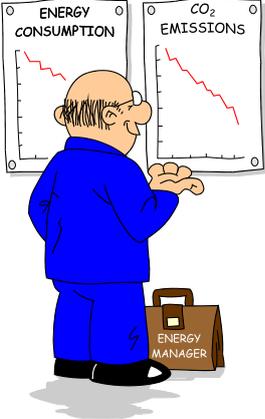
The answer is that it is the easiest type of money to spend, i.e. OPM (Other People's Money).

- **Trainer Tip:** There is no family in a developing country that wants to move into your house but there is a company in the developing world that wants to move into your company's market. Wasting energy is simply wasting money and making it easy for these companies to enter your markets and destroy your jobs.
- **Trainer Tip:** Ask the question 'If a worker sat down on the shop floor and started to read the newspaper then how long would it be before he was told him to start doing work'. The general answer is 1 - 3 minutes. This is because the focus is on what direct labour is doing, when really it should be on what the costs are doing - these are not always the same thing. The same people who told the direct labour worker to get up and start working has almost certainly walked past at least 4 areas of energy waste on their way to the worker but they ignored them because they are 'part of the scenery'. This is something we want to change.

Energy management in plastics processing

Our objective:

**To reduce energy use
by 10% within 12
months**



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Our objective

The energy saving potential at most sites is generally around 30% of the energy use but actual reduction target is set at 10%. This is ambitious but in most cases are quite achievable.

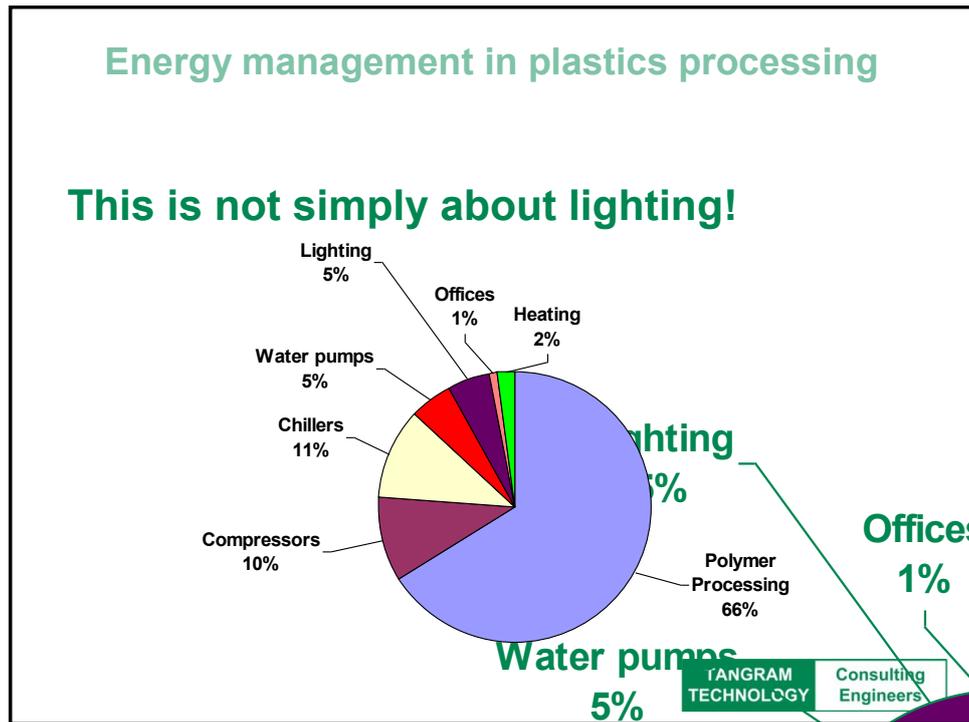
How are we going to achieve these without significant investment?

The reality is that for most UK industry energy savings of between 10 and 20% are very possible through no-cost or low-cost actions.

The type of actions we recommend are mainly what are termed 'good housekeeping'.

In the next slides we will look at some typical energy efficiency projects and try to show the costs and benefits of this 'no-cost and low-cost' approach.

- **Trainer Tip** - The point to make here is that the work to save this amount of money is not complicated or highly technical. The work mainly consists of being aware of where energy is used and some of the possible ways to reduce the amount of energy used. The reality is that once staff are aware of the 'cost of energy' and the need to reduce this then the actions to actually reduce it are very simple.



This is not about lighting

Whenever people start to work on energy management in plastics there is a fascination with lighting. This is because lighting is very visible and poor lighting usage can be seen by everybody. It is almost certain that a good few of the actions suggested in the 'Energy Inefficient Site' exercise concerned lighting.

The reality is that in most plastics processing sites the energy use by lighting is around 5% of the total energy use. This is not insignificant but there are better and more rewarding targets for initial work.

Despite this, it is always good to carry out a few lighting projects because of the psychological message they send. Staff will see the lighting projects and realise that the company is actually doing something. Other projects may not be as visible although they may be more rewarding.

- **Trainer Tip:** The %'s shown are an average indicator and do not necessarily refer to a specific site. The %'s depend on the process used at the site.
- **Trainer Tip:** This training programme will concentrate on those areas that the staff can normally change for the better. It does not concentrate on areas where large investment is needed.

Energy management in plastics processing

Where is energy used on site?

- **Services: Compressed air, cooling and chilled water, materials handling, regrinders, lighting, heating, cooling/ventilation.**
- **Processing: Injection moulding machines, extruders, blow moulding machines, thermoformers.**
- **Site: Administration functions - offices, computers, monitors, printers.**

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Where is energy used on site?

Energy is used at the site in a variety of areas. Not all of these will be obvious and not all will be present at every site.

- **Trainer Tip:** The chart on the previous slide will have shown the trainees that this is not all about lighting but it is worthwhile highlighting some of the areas that are the real energy users.
- **Trainer Tip:** Get the trainees to suggest a few energy usage areas that are not on the slide. It will involve them and may lead to some good areas for investigation.

Typical energy usage areas will be:

- **Services:** Compressed air, cooling water provision (cooling towers), chillers, cooling and chilled water pumps, materials handling (vacuum pumps), regrinders, lighting, heating, cooling/ventilation and associated fans.
- **Processing:** Injection moulding machines, extruders, blow moulding machines, thermoformers and any ovens.
- **Site:** Administration functions - offices, computers, monitors, printers.
- **Trainer Tip:** It is always worthwhile taking a walk around the site before the training session to identify some areas of 'hidden' usage such as drying, compressors, ventilation fans and air conditioning. These may not be immediately obvious but will all be using energy.
- **Trainer Tip:** If gas is used at the site it is also worthwhile looking for a few areas of gas usage such as fork lift trucks and possibly process heating.

Energy management in plastics processing

The basic areas:

- Management
- Services
- Processing
- Operations



The basic areas

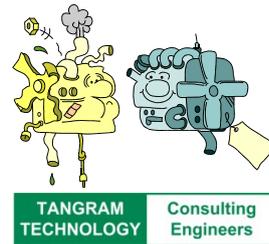
This training will be broken up into 4 areas:

- **Management:** You may not think of yourself as being in management but you are in charge of equipment and how it is used. You don't need anybody's permission to turn on machines and waste energy so you can actually manage the energy usage at the company. You may need somebody's permission to turn off machines and save energy but that is another question that we will deal with later.
- **Services:** Whether you like it or not the processes that you operate use services such as compressed air, cooling water. These may be 'hidden' and use energy somewhere else but they are still big energy users.
- **Processing:** The actual plastics processing operations are one of the largest energy users and how the people manage and operate these decides how much energy is used at the site.
- **Operations:** This is how we run the business and most of the trainees will come from the operations area. They can really control how energy is used at the company.
- **Trainer Tip:** There are only 4 reasons for using energy:
 - Providing services.
 - Machines are being prepared for work.
 - Product is being made.
 - Someone forgot to switch the machine or services off.Reduce Items 1 to 3.
Eliminate Item 4.

Energy management in plastics processing

Services - Motors

- The energy cost of a motor can exceed the purchase cost in just 40 days (1000 hours) of use
- The life cost of a motor (energy + maintenance) is often over 100 times the first purchase cost



Motors

Approximately 2/3 of the energy costs in plastics processing are the result of using electric motors.

Motors in the main processing equipment such as extruders, injection moulding machines and other main equipment is obvious but most of the motors are 'hidden' in other equipment such as compressors, pumps and fans.

The energy cost of a motor is greater than the purchase cost after only 40 days of continuous running and the lifetime cost of a motor is more than 100 times the cost of buying the motor.

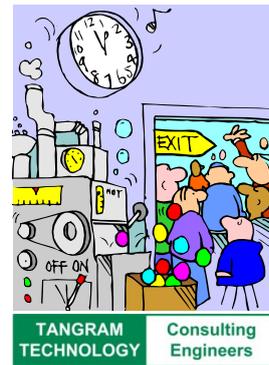
- **Trainer Tip:** Look for the hidden motors. Point out that even a simple computer has in the region of 8 motors in it!
- **Trainer Tip:** This is also true of most household goods. Over a standard 10 year life cycle, the cost of running typical 'white goods' (fridges, freezers etc.) is more than the purchase cost. This is also true for most 'brown goods' (TVs, DVD players etc.) if they are used regularly. Motors cost large amounts of money even in the home.

We need to control motors to save energy and you know where they are!

Energy management in plastics processing

Services - Motors: Switch it off!

- The first, the best and the most effective action



Motors: Switch it off!

Simply turning motors off when they are not being used will save large amounts of energy at any site.

- **Trainer Tip:** Take a quick tour of the factory before the session and look for motors operating when they do not need to be. Use these as examples for the trainees. Some simple examples could be:
 - Prime processing machinery motors operating when no product is being produced, e.g. injection moulding machine motors operating whilst the platens are not moving.
 - Conveyors operating with no product on them.
 - Fans or blowers operating with no product or operators present.
 - Swarf extract fans operating when no cutting is being done.
 - Printers ready to run with no product present.
- **Trainer Tip:** Ask trainees to suggest some motors that operate when not needed. Keep a list for later action.

Energy management in plastics processing

Services - Motors: Linking machines

- Save energy by turning machines and ancillaries off when they are not needed
- Shut down machines, conveyors, heaters and chillers when they are not being used
 - Link downstream machines so that when the main machine is not operating then downstream machines stop operating, e.g. link conveyors to the machine
 - Look for 'hidden' equipment, e.g. regrinders!
- Traffic lights

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Motors: Linking machines

The trainees can easily save energy by turning machines and ancillaries off when they are not needed. They will need to know how and when to switch them off so that there is no damage to the machines or the process.

They will need to know:

- Where the switches are and how easy there are to get at.
- What else happens when they switch a motor off, i.e. do the switches control something else?
- How long they have to wait before they switch them off.
- How long they have to wait before they can switch them on again.
- **Trainer Tip:** Take one of the examples used for the previous slide, e.g. a fan or blower and ask these questions to see if the trainees understand what they can do to switch off motors.

Is it possible to automate this process by linking the motors to a signal from the process?

This can often be done by taking a signal from the main machine to control and shutdown the downstream equipment when the main machine is not operating, e.g. if a saw is not operating then the swarf extract fan obviously doesn't need to operate, if an injection moulding machine is not operating then the conveyors don't need to operate, if an extruder is not operating then the haul-off and the saw don't need to operate.

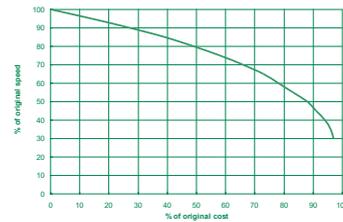
- **Trainer Tip:** Ask the trainees to think about some 'hidden' equipment at the site that could be controlled in this way, e.g. regrinders.
- **Trainer Tip:** Ask the trainee's for some examples from their process.

The Traffic Light system will be covered in a later part of this presentation.

Energy management in plastics processing

Services - Motors: Slow it down (VSDs)

- Use variable frequency drives (VSD) for fans & pumps
- Slowing a motor down with a VSD saves money
- Take a signal from the temperature or flow rate



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Motors: Variable speed drives (VSDs)

Most motors in plastics processes are alternating current (AC) and run at a fixed speed. Variable Speed Drives are a simple controller fitted to a motor that slow the motor down.

Consider an extraction fan in the roof: With a standard motor and switch this is either 'off' or 'on' and in most cases it will be on whether it is needed or not. A VSD allows us to control the speed of the motor and the amount of extraction. We can measure the temperature in the roof and when it is hot we can run the extract fan fast to cool the area. As the temperature goes down the VSD will slow the extract fan down and reduce the cooling. The temperature in the area is therefore more stable and controlled.

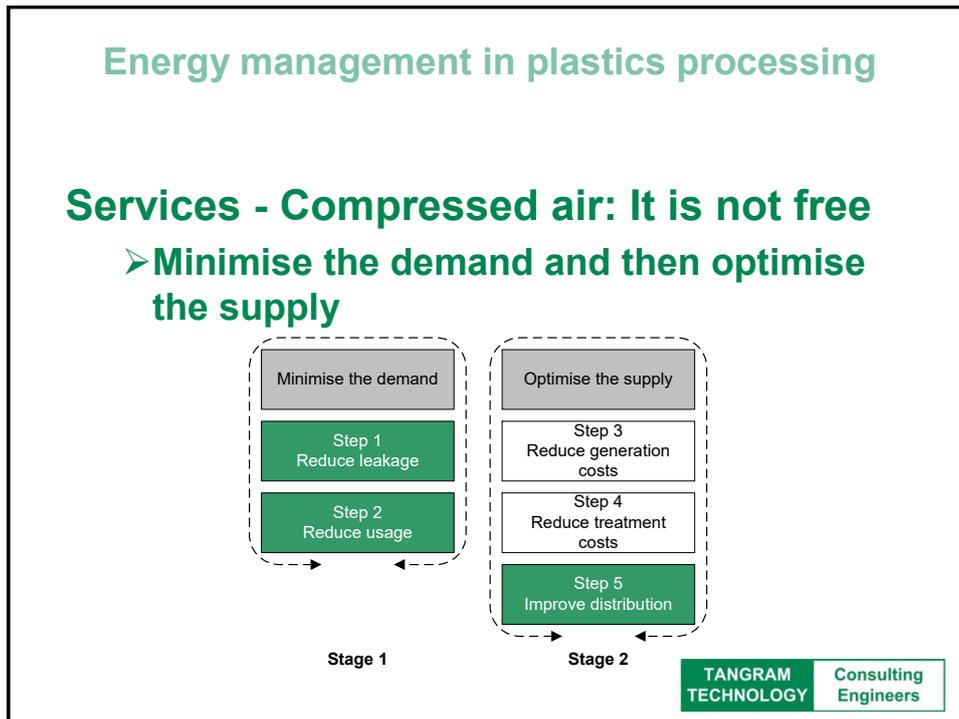
The real benefit is in the energy savings at the motor. Slowing a standard motor down by only 20% reduces the energy use by nearly 50%. Slowing a motor down by 30% reduces the energy use by 66%.

There are many areas where VSDs can be used but we have to find them!

- **Trainer Tip:** The best applications are in fans and pumps.

Typical areas are:

- Fans - extract fans (swarf, air and contaminants), cooling fans (product and people), cooling tower fans, air rings, blown film, blowers for product or material movement.
- Pumps - cooling water pumps, chilled water pumps, hydraulic pumps.
- **Trainer Tip:** Ask the trainees if they can name some fans or pumps that operate at full speed when they could be controlled by VSDs.



Compressed air

Compressed air is a convenient utility but it is very expensive to produce.

The 2 stage programme is to minimise the demand and then to optimise the supply.

This is because it doesn't make sense to optimise the supply based on excessive and wasteful demand.

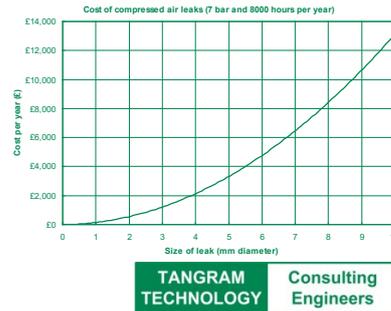
Some of the programme needs management and investment but trainees can help in several areas:

- Identifying leaks for sealing to reduce leakage.
- Identifying areas of poor usage for process improvements.
- Identifying areas to improve distribution.
- **Trainer Tip:** In many ways these are the most important areas and up to 50% of the cost of compressed air can be saved by work done by the trainees.

Energy management in plastics processing

Services - Compressed air: Leakage

- An average of 30% of the compressed air generated is lost in leaks
- If you can hear a leak it is costing at least £100/year
- A 3 mm hole will cost at least £1,200/year
- Locate and seal leaks



Compressed air: Leakage

Around 30% of the compressed air generated at a plastics processing site never gets to the point of use because of leaky systems. It is generated and then lost before it is used. This is an expensive resource indeed!

- **Trainer Tip:** Take a quick tour of the factory before the session and listen for the inevitable compressed air leaks. If you can hear them then they are costing a minimum of £100 per year to feed. Larger holes cost even more.

Saving energy by sealing compressed air leaks is not high technology. It is best to have a full survey with ultrasonic detection equipment but much of the benefit can be gained by simply realising that leaks cost so much to run and then actually doing something about it.

A quick survey

For a quick survey it is possible to use hands and ears to detect large leaks (in quiet areas). For a better survey it is possible to use a cup of water with a drop of detergent in it and an old paint brush. Paint the air joints with the water/detergent and tighten the joints/replace the components where bubbles are seen. Saving money doesn't have to be difficult.

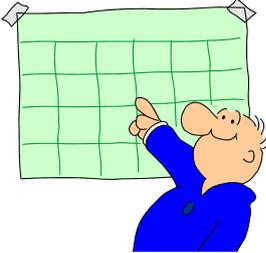
If you can find and seal a single 3 mm air leak (and this is not normally difficult) you will have saved £1,200/year.

- **Trainer Tip:** This is an excellent first project to start with. Locate and remove compressed air leaks, watch the compressed air consumption go down and then look at the size of the whole compressed air system to reduce energy usage and costs.

Energy management in plastics processing

Services - Compressed air: Usage

- Find and remove poor usage of compressed air:
 - Bowl feeders
 - Product movement
 - Cooling
 - Air guns
- Reduce usage pressure:
 - Decrease regulators to the minimum for the process



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Compressed air: Usage

At the point of use, compressed air costs more than ten times the equivalent quantity of electrical power, i.e. an equivalent cost of around 50p/kWh. At this price, it should never be wasted and only be used when necessary.

Many sites use compressed air as if it were free and have no idea of the cost of usage. An average bowl feeder (common in many injection moulding sites) will cost at least £20,000/year to operate.

- **Trainer Tip:** The trainees should not be concerned about areas where compressed air is used to move actuators in a closed system but should concentrate on areas where compressed air is discharged to atmosphere.

Compressed air discharged to atmosphere is very wasteful and costs a lot of money. A single 3mm diameter open air jet at 7 bar costs £1,200/year (the same as a similar leak).

Areas for trainees to look at are:

- Compressed air assisted ejection of product from injection moulds.
- Compressed air for robot grippers.
- Compressed air cooling of any product (try a high speed blower or fan instead).
- Compressed air in bowl feeders or any product movement (try using gravity or mechanical devices instead).
- Compressed air guns for cleaning or blowing down (try using brooms or brushes instead - it is cheaper and safer).
- **Trainer Tip:** Keep a list of the trainee suggestions for later use.

If compressed air must be used then get a regulator fitted to the line to lower the local pressure.

Energy management in plastics processing

Services - Compressed air: Distribution

- The longer the pipeline, the greater the pressure loss over the pipeline and the greater the cost
- Identify and seal unused spurs
- Stop the feed when the machine stops



Compressed air: Distribution

The cost of compressed air is not only affected by leakage and usage, it is also affected by the length of the piping and the associated leaks.

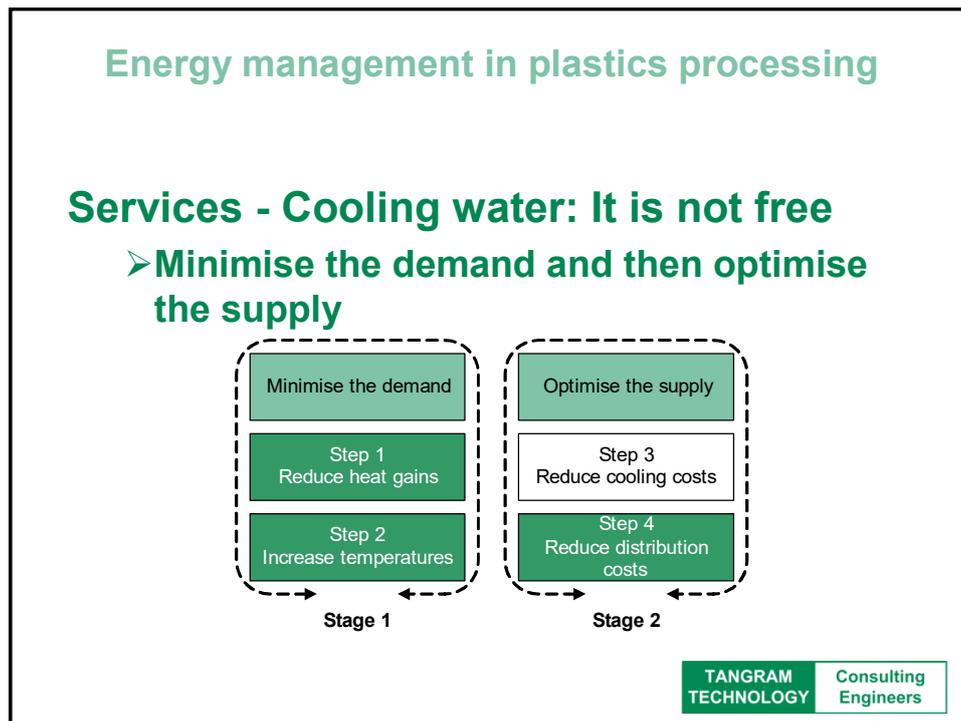
Long, old and unused pipes often have leaks that cannot be fixed cost effectively. In this case, the best action is to isolate the spur or run of unused piping so that it cannot leak.

- **Trainer Tip:** The trainees should look for long runs of piping (particularly long hose runs) and see if these actually do anything at the end of the run. If they don't then they can be sealed off (preferably with a valve) so that no leaks can occur downstream of the valve.

Servo-operated valves

As with motors it is a good idea to stop the feed when the processing machine stops. This can easily be done using a servo-operated valve that is connected to the main machine. When the machine stops the valve automatically cuts off the compressed air supply. This reduces leaks and any stray usage.

- **Trainer Tip:** Make sure that shutting off the compressed air feed does not create a Health and Safety concern.



Cooling water: It is not free

As with compressed air, cooling water is a convenient utility but it is also very expensive to produce. Cooling water can come from either chillers or cooling towers/air blast cooling depending on the water temperature needed.

The 2 stage programme is to minimise the demand and then to optimise the supply.

This is because it doesn't make sense to optimise the supply based on excessive and wasteful demand.

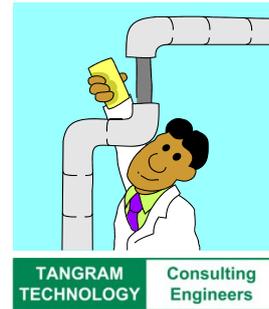
Some of the programme needs management and investment but trainees can help in several areas:

- Identifying areas to reduce heat gains.
- Identifying areas where it is possible to increase temperatures.
- Identifying areas for improved distribution.
- **Trainer Tip:** These can also be very important areas for reducing the cost of cooling water.

Energy management in plastics processing

Services - Cooling water: Reduce heat gains

- Find uninsulated cold surfaces
- Insulate these to prevent parasitic heat gain:
 - Chilled water piping
 - Cooling water



Cooling water: Reduce heat gains

In just the same way as a hot pipe will lose heat to the surroundings, a cold pipe will gain heat from the surroundings. This is called 'parasitic heat gain' and means that however the cooling water is produced the system will need to work harder and use more energy to cool the water down more.

This is similar to insulating the hot water pipes in your house to prevent heat losses to the rest of the house - it is simply in reverse but the effect is much the same, more energy is used for the same result.

The important thing is the temperature of the water at the point of application. If it warms up during transport then it has to be cooler to start with and this extra cooling uses energy and costs money.

Trainees need to think about areas where cooling water pipes are uninsulated, as these areas will be suffering from parasitic heat gain.

Any cooling water pipe that is cold to the touch can probably be insulated to save energy. One sure indicator of uninsulated piping that would benefit from insulation is the presence of condensation on the piping or small puddles of water underneath the piping in summer. This shows excessive parasitic heat gain.

Note: Be careful touching any piping. Approach carefully to see if it is hot before touching it.

- **Trainer Tip:** Get the trainees to identify any areas of uninsulated cooling water piping or of condensation/puddles on the floor. Keep a list of these for later projects.

Energy management in plastics processing

Services - Cooling water: Increase temperatures

- How were the cooling water temperatures set?
- Can they be increased?
- Increasing temperatures decreases chiller loads and decreases costs



Cooling water: Increase temperatures

After parasitic heat gains have been eliminated it is often possible to increase the temperature of the cooling water flow. Cooling costs money (chillers are just compressors in disguise) and increasing the flow temperature decreases the cost of cooling water.

In some cases the trainee will not be able to affect the temperature of the cooling water as this will be set by the system controls or by the process technicians. Trainees should not adjust these without permission.

This does not stop trainees from asking if the cooling water temperatures really need to be as low as they are because even small increases in the flow temperature can save large amounts of energy.

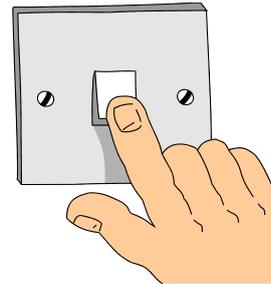
The questions to ask are:

- How were the cooling water temperatures set?
- Can they be increased?
- **Trainer Tip:** Get the trainees to identify any areas where the cooling temperatures could be increased. There may not be a lot of areas because trainees may not be familiar with the process. Keep a list of these for later projects.

Energy management in plastics processing

Services - Lighting: Switch it off

- **Switch it off - Turning lights off when leaving a room or corridor (when not required) can reduce the daily cost by 15%**
- **Lighting an office overnight wastes enough energy to heat water for 1000 cups of tea**



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Lighting

Lighting is an emotive subject and sites will always need to look at lighting to send the right message to the staff.

As with motors, large gains can be made simply by encouraging people to turn off lights when they are not needed.

This means that people have to change their behaviour and this is part of why we are having this training programme.

- **Trainer Tip:** We do not recommend simply using 'Turn Out The Lights' stickers. They may work for a short time but after 3 months people will have forgotten that they are there and the behaviour will not have changed.

Simple actions can have large results and simply turning off the lights when leaving a room can reduce costs dramatically. We will cover the costs of fluorescent lighting in the next slide.

Leaving lights on overnight in offices is a major energy use in office areas and this is mainly caused by people not knowing where the switches are or what they control. We can change this.

Energy management in plastics processing

Services - Lighting: Fluorescent tubes

- In a conventional filament lamp only 10% of the energy goes into light the other 90% goes into heat
- A fluorescent light tube uses 500 times more energy if left on for 15 minutes than the energy required to restart it!



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Lighting

There is a common myth that turning out a fluorescent lamp results in high energy use when the lamp is switched back on again and that you should leave them on unless you needed the light again within 15 minutes.

This is not true even for the older T12 fluorescent tubes (the big thick ones) and is definitely not true for the modern T8 tubes (the slimmer ones) or T5 tubes (the very thin one) that are used in most new buildings.

One of the probable reasons for this myth is that turning the old T12 tubes on/off rapidly tended to reduce the tube life (it never had anything to do with energy saving). New style tubes are far more reliable and have a much longer life than the old style tubes (whether switched on/off or not).

The energy needed to restart a modern T8 or T5 tube is far less than the energy required to run it for 15 minutes. In fact you only have to turn the light off for more than 2 seconds to save energy with a new T8 or T5 tube.

Energy management in plastics processing

Services - Lighting: Controls

- Locate switches in the right places
- Identify and label switches
- Zone lighting
- Automate lighting
 - Presence detectors - Safety
 - Light level sensors - Daylight



Lighting

A major reason that people do not turn off lights is that they don't know where the switches are or what they control.

Location

Switches need to be located in the right places and people need to know where they are. It is always best if the switches are located near the entrances/exits so that people can easily switch the lights off/on as they enter or leave the room.

Labelling

Switches should always be clearly labelled with their function so that people can control the lighting. When a person is presented with 6 switches then they will leave all the lights on rather than switch off the wrong one. Clearly label all switches.

Zoned lighting

When a large number of lights are controlled by a single switch then all the lights will be turned on whenever any of them is needed. Good lighting zoning with consideration of transit routes and work areas will always save money (provided the switches are labelled).

Automation

Rather than rely on people to turn off the lights then it is far preferable to use lighting automation systems such as presence detectors or PIRs (passive infrared) to control lights. If nobody is present (or if they are asleep) then the lights go off automatically.

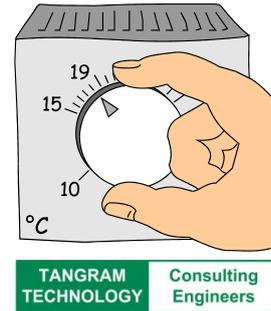
- **Note:** PIRs in some areas should be avoided because of Health and safety concerns, i.e. in service areas where the detectors may not detect people working behind machines.

Lighting automation can also be used control lighting levels so that rather than being simply on or off the brightness adjusts to the amount of daylight available. This keeps the lighting level constant and uses any available daylighting to reduce lighting costs.

Energy management in plastics processing

Services - Heating: Turn it down

- Staff are always tempted to alter thermostats because they think that they are too hot or cold
- Simply turning down the thermostat by 1°C can save significant energy
- Controls save real money



Heating

Heating and cooling are always sensitive issues particularly in offices. Many people assume that they should be able to come to work, whatever the weather, in a short sleeve shirt and that the company has to keep the area warm enough for them to be comfortable. At home their behaviour is very different, they simply wear more clothes in cold weather. Another case of Other People's Money (OPM)?

In offices there is conflict between people who think it is too cold and those who think it is too warm. Those who think it is too cold will often bring small portable heaters into work increasing energy use and spending OPM.

These conflicts will lead to constant changing of thermostats and increased energy use as those who are too hot will often open windows to cool down.

Uncontrolled heating use is always a large cost and simply turning down the heating by 1°C will reduce heating costs by 8%.

Controls

As with lighting, improvements in controls can give large savings by reducing temperatures at night when offices are unoccupied.

- **Trainer Tip:** This is often an emotive area. Stay away from the emotions and simply point out the energy and cost savings possible.

Energy management in plastics processing

Services - Heating: Seal it up

- **The cheapest method to reduce heat loss is to close doors and windows unless they are needed for ventilation**
- **Draught proofing doors and windows is a cheap and effective method of reducing heat loss**
- **Use automatic fast-acting roller shutters on external doors**



Heating

One of the key areas in energy efficient heating is to make sure that the heating is not operating when doors and windows are open, i.e. that you are not excessively ventilating the heated area.

The cheapest method to reduce heat loss is to ensure that doors and windows are closed when the heating is operating. If there is a need for ventilation then make sure that this is 'trickle ventilation' which allows some control of the air flow.

Draught proofing doors and windows is a cheap and effective method of reducing heat loss in any building. It also reduces summer heat gains if the building is air conditioned.

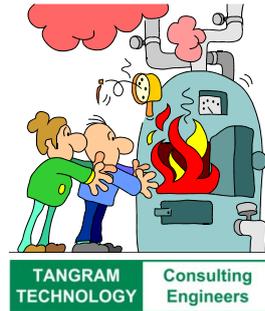
Production areas that use forklift trucks are particularly vulnerable to having large doors left open so that the trucks can move product around. These are not closed by the drivers (who are dressed for the cold weather) and the operators turn up the heating to compensate. There are two solutions:

- Fit fast acting automatic doors with induction loops to control the doors. These are an excellent solution but are expensive.
- Link the heating to a micro-switch so that when the door is open then the factory heating is switched off and will not operate, i.e. door open = heating off and door closed = heating controlled by thermostat. This will change behaviour quickly.
- **Trainer Tip:** Get the delegates to suggest some ideas for reducing the heating use at the site. They all know how to insulate their own homes (it is their money) so use their ideas for the workplace as well.

Energy management in plastics processing

Services - Heating: Make it local

- Avoid ventilating and heating the whole building space when only local areas need it
- Shut down heating in areas that are not occupied
- Do not heat warehouses simply to prevent excessive dampness



Heating

Heating is often used in areas which have no need of heating.

It is likely that the whole of a building is heated when really only some local areas actually need heating. Heating use can be reduced by partitions and by only heating the specific areas that need actually heating. This means that controls are needed to allow areas that are not being heated to be isolated from the system.

- **Trainer Tip:** Ask the trainees if it is possible to segregate areas that need heating from areas that do not need heating. Is it possible to use partitioning to locally heat areas rather than to heat the whole area? Keep a list of these for later projects.

Any heating system needs controls to select the areas to be heated but these are often not reviewed regularly. A system review would normally show this but many systems are not reviewed as long as they continue to operate. There are often unoccupied areas that still have heating supplied to them.

- **Trainer Tip:** Ask the trainees if there are any heated areas that do not need heating because they are not occupied. Keep a list for later projects.

Warehouses are often heated to simply prevent dampness affecting packaging or to prevent sprinkler systems from freezing:

- Dampness can often be reduced simply by dehumidification (which is cheaper than actual heating).
- Sprinkler system pipes can be frost protected by 'trace heating' (wires wrapped around the pipes to keep them warm without heating the whole area) or by the use of 'water-free' sprinkler systems (the sprinklers are not filled with water until required so there is no need to keep them warm).
- **Trainer Tip:** Ask the trainees if there are any heated warehouse areas that can be reviewed to reduce the heating load. Keep a list for later projects.

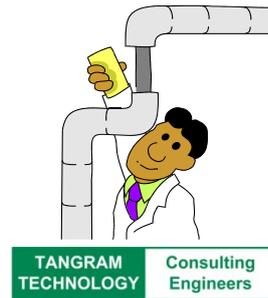
Energy management in plastics processing

Processing - Process heating: Insulate, insulate, insulate

➤ Insulate hot surfaces to prevent heat losses:

- Moulding machine barrels
- Transfer pipes and dies
- Mould temperature controller piping
- Ovens

Not extruder barrels!



Process heating: Insulation

Heat leakage loses heat and uses more energy. Radiated heat also makes plastics processing sites hot and uncomfortable in summer. In winter this heat keeps the factory warm but there are better and more efficient ways of heating factories.

Heat management is critical to the energy efficiency of plastics processing. Heating mostly uses resistance heating and the amount of energy used in these can be checked by looking at the ammeter for the heater band. Insulation of any heater band where the ammeter is constantly showing a load (or where it is cycling constantly) can reduce energy costs.

- **Trainer Tip:** Get the trainees to suggest areas where insulation of the process could reduce energy costs. Keep a list for later projects. Typical areas are:
 - Moulding machine barrels.
 - Extruder transfer pipes.
 - Extruders downstream of the screw tips.
 - Mould temperature controller piping (for hot water or oil).
 - Ovens for thermoforming

Note: Check the process to make sure that the heat leakage is not deliberate. In some cases we want the process to lose heat. This is usually the case in extrusion where the barrel gets hot from mechanical heating (friction) and most of the time we want to take heat out of the process.

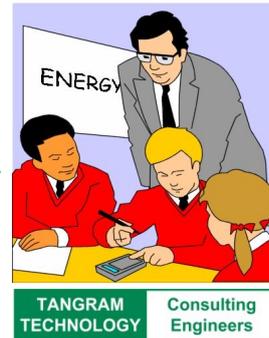
Note: Always be very careful near hot pipes and other metal parts. Do not touch them unless you know it is safe. Most plastics processes use temperatures that are high enough to cause burns.

- **Trainer Tip:** Insulation also removes any Health and Safety concern with hot surfaces.

Energy management in plastics processing

Processing - Production planning

- A machine 'throttled down' to low production compared to capacity is inherently inefficient
- Schedule jobs to the most appropriate (the smallest capable) equipment
- A machine is wasting energy making product to a higher specification than needed



Production planning

Working smarter is one way to reduce energy costs (and often other costs as well). Simply re-arranging the production schedule and switching off when not required can save significant amounts of money for no expenditure.

Machine selection

Machine selection in plastics processing is critical to getting the best out of the machines. Unlike cars, where it pays to drive slowly, most plastics processing equipment is more energy efficient when it is being run hard. This is because of the fixed losses in any machine. Using a large machine to produce a small part is never energy efficient. A machine 'throttled down' to low production compared to capacity is inherently inefficient.

Make sure that the machine selected is the smallest capable of doing the job.

Schedule jobs to the most appropriate equipment.

- **Trainer Tip:** Ask trainees if they know of any products being produced on large machines that could be rescheduled to smaller machines. Keep a list of these for later projects.

Specification

Quality is very important but producing to a higher specification than the customer needs will always use more energy than producing exactly what he needs. A machine is wasting energy making product to a higher specification than needed.

- **Trainer Tip:** Ask trainees if they know of any products being produced to a higher specification than necessary. Keep a list of these for later projects.
- **Trainer Tip:** The way we process products dramatically affects the amount of energy that we use in the production area. This section is not designed to start operators changing processes or specifications but simply to make them aware of the possibilities for reducing energy costs by working smarter.

Energy management in plastics processing

Operations - Start-up, stand-by and shut down

- Start up and shut-down machines in the right sequence to reduce energy use
- Isolate shut-down machines
- Define a 'stand-by' condition
- Document and implement start-up, shut-down and standby procedures



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Start-up, stand-by and shutdown

Start-up and shut-down

Equipment should be started up in an orderly sequence to bring the demands on-line as needed and not before. Most plastics processing machines need to heat up before the main motors need to be turned on. Starting motors before the machine is hot will waste energy.

- **Trainer Tip:** Ask trainees to think of methods that could be used to minimise energy use during start-up. Keep a list for later projects.

Shut-down is equally important. Machines need to be shut-down in the most energy efficient manner, i.e. shut down the main motors first to reduce the load quickly.

- **Trainer Tip:** Ask trainees for methods to minimise energy in shut-down. Keep a list.

Isolate shut-down machines

Machines that are shut-down should be isolated from all services. Not simply isolated from the electrical supply but also from services such as compressed air and cooling water. It is a waste feeding compressed air leaks or supplying cooling water to a machine that is stopped. The energy use at the services and not at the machine but it is still wasted energy.

- **Trainer Tip:** Ask the trainees how they can isolate shut-down machines. Keep a list.

Define a 'stand-by' condition

Machines in 'stand-by' are using energy for no production. This can be reduced by setting them to 'stand-by', i.e. motors off, heater bands 'set-back' and downstream equipment off.

- **Trainer Tip:** Ask the trainees how machines can be set in 'stand-by'. Keep a list.

Document and implement start-up, standby and shut-down procedures

All of these ideas can be used to reduce energy usage but only if they are followed. Trainees should be encouraged to document the settings for real use.

Energy management in plastics processing

Operations - Traffic light system

➤ **Colour coding so that everybody knows when and where equipment can be turned off.**



Green - Turn off without question when not used



Amber - Obtain permission to turn off when not used



Red - Must NOT be turned off

Traffic light system

It is always difficult to know what can be switched off and what needs to be left on for operational or Health and Safety reasons.

One easy way of defining this is to use the proven 'Traffic Light System'. Machines and services can be assessed by the production and maintenance teams and colour coded with traffic lights to show their status.

Green: Operators and staff can turn this equipment off on their own initiative whenever they think that it is not needed. This is for non-critical machines and services.

Amber: Operators and staff should seek permission from other staff, e.g. the shift supervisor, before turning this equipment off. This is for sensitive equipment that may affect other processes or equipment, i.e. turning off some machines may reset the memory.

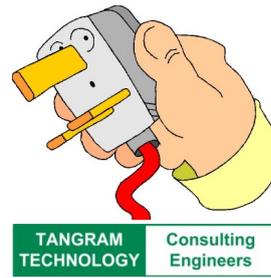
Red: Safety or process critical equipment that must not be turned off for any reason.

This simple system allows operators and staff to easily decide whether equipment should be turned off or not.

Energy management in plastics processing

Operations - Traffic light system

- Based on equipment/area mapping
- Every cell member should be aware of what and when equipment can be turned off/shut down
- Turn equipment off when **NOT** required!
- Eliminate equipment from dry-cycling!
- Make suggestions



Traffic light system

A traffic light system is normally based on mapping the area so that the complete team understands the process and has a clear idea of the process.

It must be used!

Every team member needs to understand that the system is only useful if equipment is actually turned off. This means that team members need to actually make the decisions and turn the equipment off when it is not needed. Simply leaving it on is not the option.

Dry cycling

A traffic light system also eliminates dry cycling of machines. A process that not only wastes energy but can also be damaging to some machines.

Suggestions

Operators need to use the system and to update it by making suggestions about other machines and services that can be included in the system, e.g. all personal air-conditioners and heaters!

Energy management in plastics processing

Operations - Machine setting

- Tweaking of machines by operators (to get more production) causes lost time and energy
- Get machines set right, record the settings and do not change them
- Monitor the process and do not change settings whilst 'in control'



Machine setting

Machine tweaking

Machine 'tweaking' by operators or setters to allegedly get more production from the machine causes more lost time and energy than almost any other cause. Machines should be set right by the process engineers or setters, recorded on the production system and not changed unless there is a significant change in the process.

There is no excuse for changes being made unless the basic process has changed.

Process monitoring

Machines should be monitored (preferably by SPC) for performance. No changes should be made to the machines unless the data shows that the machine has gone 'out-of-control'. If a machine is 'in-control' and producing good product then there is no reason to change the process settings.

Energy management in plastics processing

Operations - Offices

- The energy used by computers, photocopiers, printers and fax machines can be reduced by over 50% by using stand-by features
- The cost of running a PC + monitor can be reduced from £63 a year to just £6
- Seven day timers are easily fitted to reduce energy costs



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Offices

Energy saving features

Whilst the actual plastics processing uses the most energy, it is easily possible to reduce energy costs in offices by some simple measures and by activating the stand-by features that are present on most modern office equipment.

Activating these features for most equipment will reduce the energy cost by over 50% and for a typical PC + monitor can be reduced from £63/year to just £6/year.

- **Trainer Tip:** Get the trainees to suggest equipment that should have the energy savings features activated. Keep a list of these for later projects.

Seven day timers

Many offices use shared equipment such as printers and photocopier. This type of shared equipment does not belong to anybody and because nobody is responsible then nobody does anything about turning it off at the end of the day. Seven day timers are easily bought and fitted to this type of equipment.

Seven day timers can be programmed to turn off the shared equipment at 7:00 at night and turn it on again at 7:00 in the morning. Over the weekend they can turn it off at 7:00 on Friday and turn it on again at 7:00 in Monday morning. This simple action will reduce the energy use of this type of equipment by 64% for a very low cost.

- **Trainer Tip:** Seven day timers should be regularly checked to make sure that they have not been set to 'manual' or 24/7 operation.
- **Trainer Tip:** Get the trainees to suggest equipment that could easily be fitted with seven day timers. Keep a list of these for later projects.

Note: Fax machines are obviously not included! (if you still have one).

Energy management in plastics processing

Auditing

- We are going to start auditing today
- We are going to do an energy 'walk-around'
- We want to find 'hidden' energy usage
- We want to find some 'unproductive' energy usage
- We want some projects!



Auditing

Auditing is the process of actually finding the energy savings projects that we can do quickly and easily and we want to start auditing today - with you!

We are going to carry out a 'walk-around' where you look at your work area and make suggestions for improving our energy management.

We want you to look for 'hidden' energy usage.

We want you to look for 'unproductive' energy usage.

We want some projects!

This is an opportunity for you to have some input into the project selection process.

Energy management in plastics processing

Lets go see if we can find some potential savings opportunities in your area

Lets be safe and careful

1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____

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Potential opportunities

- Write down the opportunities.
- Keep the analysis for later - get the ideas down first.
- Look for the big savings.

Trainees should be given approximately 20 minutes in their own work area to come up with potential opportunities to reduce energy usage. Try to get the trainees to note down ideas without considering the cost at this stage. After returning to the training area, get the trainees to read out their individual lists before letting any discussion begin. The trainer should record these for later use.

- **Trainer Tip:** Try to get the trainees to avoid behavioural changes and try to get them to think of things that will change the structure of how they work, e.g. rather than trying to get them to turn off lights, get them to suggest areas for installing PIR activated lights so that nobody has to remember to switch them off! Structural changes are easier to implement and more permanent than behavioural changes.
- **Trainer Tip:** This will become a discussion and will generate not only potential opportunities but will also become a discussion about cost and feasibility. Do not let evaluation of the ideas start before they are written down. Keep analysis for later. Energy efficiency is easy to ignore because of pre-conceptions about cost and effort. At this stage the need is for ideas and not for deep analysis.
- **Trainer Tip:** Do not attempt to prioritise opportunities.
- **Trainer Tip:** Keep the ideas as a reference for the future. The trainees know where the energy wastage is - often they have simply never been asked before. The results of this exercise can provide some excellent ideas for small-scale energy efficiency projects.
- **Trainer Tip:** Try to implement some of the ideas quickly to reinforce the message that the company is serious about energy management.

