



## **Energy and Sustainability Topics – Accounting for energy efficiency**

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# Energy and Sustainability Topics – Accounting for energy efficiency

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## Accounting for energy costs

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### 1. The climate change levy – focusing the efforts

Rising energy costs have prompted many plastics processing companies to investigate methods of reducing energy costs. Despite this, the achieved reductions on energy use are often far smaller than those possible. One of the major reasons is that energy efficiency is seen as a ‘technology fix’ that has little to do with the financial aspects of the company – the activities are seen as involving only the technical and production areas and not rewarding enough for the other staff to get involved.

Nothing could be further from the truth and some of the most effective energy efficiency efforts can come directly from the accounting function. So why is it that the accounting function pays little interest to energy efficiency and the positive benefits?

### 2. The magnitude of the costs

The magnitude of the energy cost to plastics processing companies is illustrated below:

Manufacturing Costs		
	Volume	Complex
Materials	80%	45%
Machine	10%	25%
Tool	5%	20%
Labour	2%	5%
Packing & transport	3%	5%
Total	100%	100%



Machine Costs		
	Volume	Complex
Energy	39%	20%
Water	20%	4%
Auxiliary	1%	1%
Plant	40%	75%
Total	100%	100%

For mass produced volume parts, the energy cost represents around 4% of the total cost of the part and for complex technical parts it represents around 2% of the costs. Good energy management can reduce these costs by up to 30% and therefore reduce the overall product cost by up to 2%. If margins are low then this can translate into a significant increase in profits (up to 100% in some cases).

Any activity that can raise profits by up to 100% should certainly attract attention in any company. Many companies do not hesitate to spend money on trying to increase sales but fail to see the benefits spending money on increasing profits by increasing energy efficiency – ‘turnover is vanity but profit is sanity’.

### 3. The standard procedures

In many companies there are few controls on the energy spend. The energy bills are received by the accounts department, regarded as a fixed cost and paid. The people who control the expenditure rarely see the bills.

This separation of authority and responsibility makes management and control of the energy spend nearly impossible and reduces the effectiveness of any efforts to reduce the costs. The spend to reduce the costs is allocated to the production department but the benefits of the spend are rarely seen by that department. When an activity receives all the costs but none of the benefits or recognition then it is not surprising that little gets done.

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The reason for this separation is that energy is seen as an overhead, as a fixed cost and as part of the price of doing business. The reality is that the total energy cost is a combination of both fixed and variable costs and effective energy management can be used to reduce both of the components. Accountants are familiar with calculating the total cost of a product from the fixed and variable components, where:

$$\text{Total product cost} = \text{Fixed costs} + (\text{Production volume} \times \text{unit variable cost})$$

Similarly, the energy cost processing is made up of fixed and variable components, where:

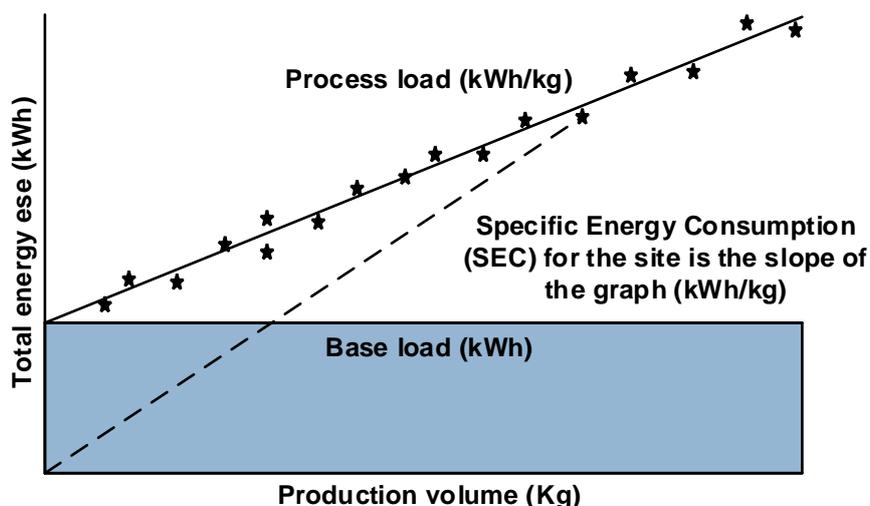
$$\text{Total energy use} = \text{Base load} + (\text{Production volume} \times \text{Process load})$$

- The 'Base load' is incurred irrespective of whether production is taking place or not – it does not change as output changes.
- The 'Process load' is the incremental energy use incurred in producing each kg of product – it increases as the production volume increases.
- The site SEC is the 'Specific Energy Consumption' – it is a measure of the amount of energy used to process each kilogram of finished product at a given production volume – it is similar to the total product cost in a standard costing system and changes as the production volume changes.

As with any cost management process there are two methods of reducing the total energy use:

- Reduce the Base load to reduce the fixed costs.
- Reduce the Process load to reduce the variable costs.

The relationship of the base load, process load and the SEC are shown below:



## 4. Measuring to manage

These ideas allow energy management to be integrated into the accounts as with any other cost element and accounting for energy management can be treated in the same way as other items in the accounts systems. The overall aim is to achieve cost-effective energy management and integration of energy reporting into the accounting function allows energy to take its place on the management agenda as a part of the normal management of the business.

In spite of this, the majority of companies have no active energy management programme or even reporting system. They consider that it is not central to their core business and are unaware of the potential for improvement or the substantial returns that can be made through small investments in energy efficiency. This needs to change to improve profitability.

To integrate energy into the accounting function there is a need to establish the measures that will be used to assess performance and this requires both monitoring and targeting.

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## 5. Energy M&T

In energy management, the concept of monitoring and targeting (M&T) is used to focus attention on energy consumption and the identification of cost reduction opportunities with attractive returns on investment.

Energy M&T is the collection, interpretation and reporting of information on energy use. It measures and maintains performance and locates opportunities for reducing energy consumption and cost.

In most companies, the information needed for initial M&T can be taken from an existing Management Information System and a large part of the benefits can be achieved by simple analysis of existing information. Basic historic data and a spreadsheet can be used to set up a simple system to start formal M&T.

**Note:** Gathering data will not, in itself, provide results. The potential benefits of energy efficiency cannot be achieved by collecting large amounts of data or preparing lengthy reports. Data is meaningless without careful analysis, and reports are useless if they are not targeted at people with the authority and the will to act.

For smaller companies, M&T needs to be appropriate to the energy spend. M&T may require improved metering capability for cost allocation. The cost of a meter does not vary much with the amount of energy that goes through it and, for a smaller company, the justification for investment in additional metering becomes more difficult. For a larger company, the decision is not whether to install meters to allow a breakdown of the costs, but how many meters and where to put them.

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**Set the energy management structure ...**

**... then use the structure to set targets and implement projects to achieve the targets**

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## Measuring energy costs

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### 1. Data collection

Measuring costs always involves the collection of data but there is no point in spending more money to collect data than can be saved by the useful application of that data. It is always necessary to critically assess the cost-benefit balance for data collection. It is also important to recognise that good quality data is not necessarily the same thing as highly accurate data. The need is for enough relevant information to promote action – collect only the minimum amount of data necessary to produce the relevant information.

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### **The prime function of the energy information system is the support of the overall strategy of the organisation**

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Most of the core production data is probably already being gathered for cost and production control purposes. This data can often be used with minimal changes as part of an energy M&T system and sharing this data may only require simple modifications to enable a basic but effective M&T system. Production data is either related to amounts (e.g., weight, volume, number of items) or does not relate to amounts (e.g., density, moisture content). Amount related data is 'additive' and information for a week can be obtained by adding the daily data. Data not related to amounts is 'non-additive' and can sometimes be difficult to summarise and use. Despite this, it may be difficult to establish an effective M&T system without recording some 'non-additive' data (e.g., it may be difficult to assess energy usage when there are large variations in polymer moisture content and the drying process uses a significant amount of energy).

Other data may require specific collection for M&T (e.g., regular meter readings) and this may be collected either manually or automatically (such as the ½ hour meter readings available from the electricity supply company).

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### **Planning the way energy management is organised is a senior executive responsibility which will determine the success or failure of the energy policy....**

**...this goes well beyond simply appointing an energy manager**

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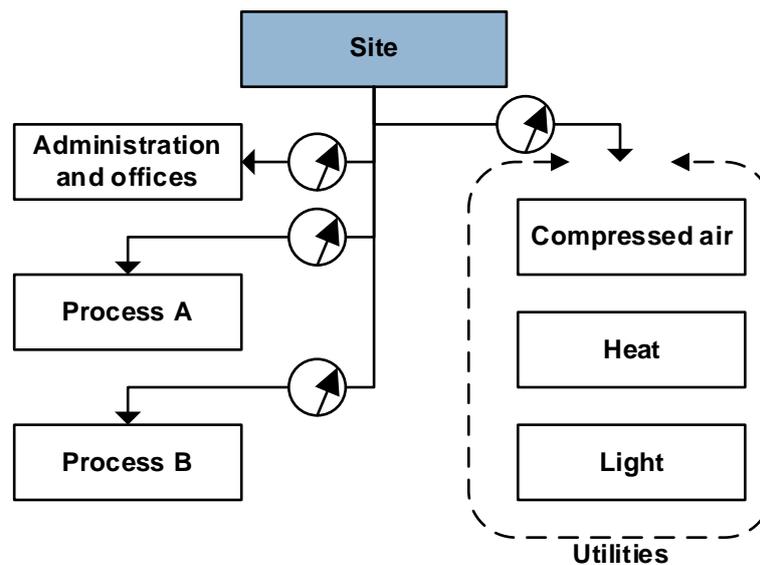
### 2. The basic data

The basic data needed for energy accounting falls into three categories:

**Consumption data** – This is the most basic data of all and is collected via the site metering system. There is a common misconception that M&T requires the installation of large numbers of meters. The use of sub-meters enables accurate allocation of costs (see below) but substantial progress on M&T can be made with only a single meter. The average UK plastics processing company is small and would find it very difficult to justify sub-metering. For larger sites, where the cost of sub-metering is small in relation to the amount of energy used, it is possible to justify sub-metering and a possible arrangement is shown in the figure at right. This arrangement allows the process energy requirements (generally variable) to be separated from the building and utilities requirements (generally more fixed).

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**Cost data** – Money is the common language of business and only by expressing energy data in cost terms can integration into accounting function take place. Cost data comes from the supplier bills and must be part of the M&T system.

**Driver data** – This is data about the factors that influence energy consumption and can be divided into 'activity' and 'condition' drivers:

- Activity drivers are those where a feature of the company activity influences energy consumption. Activity driver data can generally be gathered from internal sources, e.g., production data.
- Condition drivers are those where the consumption is not affected by the activity but by external conditions. Condition driver data generally needs to be gathered from external sources e.g., degree days for heating data.

For most plastics processing, the main 'activity' driver is the number of kilograms processed (which affects energy use through the process load) and the main condition driver is the weather (which influences the heating loads on the factory). As with all accounting, no costs are totally fixed and no costs are totally variable e.g., the base load is essentially fixed but is also affected by the weather (a condition driver).

## 3. Converting data to information

Data has no value unless it is converted into information; the simple presentation of data is not sufficient to account for energy efficiency. Producing information requires basic skills in data analysis and the techniques are generally well known to accountants and engineers.

Typical analytical techniques are:

- Specific Energy Consumption – The SEC is used to benchmark standard industrial processes. The SEC is simple, easy to calculate and straightforward to communicate.
- Comparisons – These allow comparison against current and past energy performance but should be normalised to account for variations in the drivers for the periods considered.
- Trend lines – These graphically show the trend in energy use (preferably downward) over time. Trend lines can be produced using 'moving averages' to account for driver variation.
- Energy Profiles – These can be produced using supplier data to reveal changes in consumption over short time periods. They are useful for identifying short-term variations in energy use.
- Lines of best fit – These are useful for producing simple relationships between drivers and energy consumption to aid prediction and to understand how various drivers affect consumption.

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- Variances – Variance are frequently used in accounting to show deviations between actual and predicted energy performance. Whilst useful for an overview, they do not identify areas for improvement or drive improvement.
- CUSUM – Cumulative SUM of variance from standard performance charts are one of the most powerful methods of identifying and quantifying the impact of changes in energy use.
- Control charts – These are similar to the typical control charts used in Statistical Process Control and can highlight deviations from planned or standard performance.

## 4. Assigning the costs

Cost reductions only happen if somebody is made directly responsible for them and after data has been converted into real information it is necessary to attempt to assign the costs to create ownership.

When monthly accounts are prepared for any business, the operational costs are directly assigned to individuals who are responsible for the performance of that section of the operation. Energy costs should be treated in the monthly accounts package in the same manner as similar operational costs. Transport, accounts receivable and supplier days are treated with some gravity but energy is often conveniently forgotten in the process of assigning accountability.

Methods of assigning accountability vary with the existing company process but typical methods are:

- Energy Accountable Centres make Departmental Managers accountable for the energy costs of their department. This involves allocating energy costs to departments and requiring them to operate within the allocated budget and to achieve agreed targets. It depends on the ability to measure local energy consumption and requires direct control of the energy consumed.
- Quality centred M&T is based on the requirement within quality and environmental management systems (ISO 9001, ISO 14001) for an information system and shares information with these. The advantage of applying energy accounting within such systems is that it uses existing management structures and is less likely to be marginalised as an activity.
- Activity Based Costing (ABC) recognises that income from manufacturing is determined by the price the market will accept but income has to cover costs. Costs are added by 'activities', but some activities add value and others do not. ABC identifies activities that add more cost than value. Originally activities were what people did (because of the way overhead costs were assigned in proportion to direct labour costs) but activities can include overhead costs such as energy.

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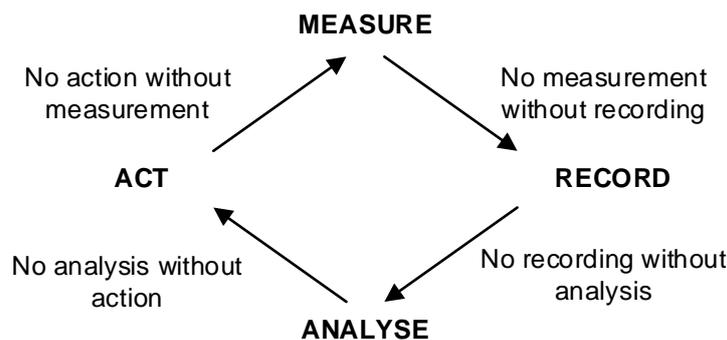
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## Targeting and controlling energy costs

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### 1. The management action cycle

Accounting, measuring and allocating the energy costs does not necessarily reduce them. Cost control and reduction only result from action and as with any information system, there is a need to report the costs and to use these reports to stimulate action. The Management Action Cycle (shown below) provides a template for successful management:



#### The management action cycle

If any action is to be successful the system should:

- Have the full support and commitment of senior management.
- Support existing lines of responsibility.
- Use analysis appropriate to the process to ensure adequate control.
- Involve the people it serves accommodating both their views and desires to offer solutions and have their performance judged on fair criteria.

### 2. Setting targets

Setting achievement targets is necessary for action but effective targets must be set to provide a real incentive for action.

The characteristics of effective target measures are:

- They should be clearly communicated to the employees: 'I will succeed if you tell me what to do and where you want me to improve'.
- They should be largely non-financial and used by all employees: 'Tell me in terms I can understand'.
- They should reflect the performance required at the location: 'Give me something that is relevant'.
- They should vary with time to reflect changing organisation goals: 'I've got that right so let's move on to the next priority'.
- They should be simple and easy to use: 'I understand that'.
- They should be fast to give quick response and feedback: 'Is today soon enough?'.
- They should aim to teach rather than monitor and produce improvement rather than simple historic reporting: 'OK, now I see where I can get better'.

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**Study the data before developing the system**

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## 3. Monitoring and reporting targets

After targets for improvement have been agreed and set, it is necessary to report on progress to ensure that effective action has taken place. Any energy accounting report should support the targets set and meet the following requirements:

- The report should reach the manager who controls the relevant resource.
- The manager should be able to understand what the report means to them.
- There should be a minimum of extraneous information.
- There should be some means of ensuring that action is taken when it is needed.
- The reports should be integrated as far as possible into the existing management information systems to make energy accounting a part of the normal operations of the company.

As a general rule, it is more important that the information reporting system does what the company needs rather than does many things that it does not require. In most cases, simple spreadsheets offer a method of starting with very basic numbers and then developing the spreadsheet as the needs grow.

The type of report produced should match the needs of the audience to the information in the report:

- Annual reports should provide top level performance information to show progress over the period.
- Monthly reports should match the format for conventional financial reporting and be incorporated into these.
- Weekly reports should more detailed operational target information to provide rapid feedback on operational issues.
- Key indicator reports should be designed for general consumption and produced as colour charts suitable for posting on notice boards.
- Exception reports should be produced for Departmental Managers on areas where targets have not been met or for identification of areas for improvement.

Distribution of reports is always a key area. Not all levels of staff require the same information and the reporting should vary to reflect the needs of the audience. A recommended matrix for distributing information is:

Distributing the information					
	Annual report	Monthly report	Weekly report	Key indicators	Exception report
Managing Director					
Finance Director					
Department Heads					
Purchasing					
Supervisors					
Workforce					

**What information do recipients need?**

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## The system must turn data into action to improve energy and financial performance

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### 4. Sustaining the System

The greatest threat to energy accounting is where the system operates but no one takes any notice, there are four reasons for this:

- Lack of authority – where the system does not have senior management support.
- Lack of ownership – where the staff are servants of the system rather than vice versa.
- Lack of accountability – when there is no clear linkage between responsibility and authority.
- Lack of resolution – where the system highlights concerns that do not really exist or does not highlight concerns that do exist.

### 5. Summary

The accounting function can provide a range of tools and experience to reduce energy consumption. It is truly part of the accounting function to become involved in this area. It is no longer enough for them to claim that there is no accounting for energy efficiency.

### 6. Checklist for the action cycle

#### Measure

- Ensure that production/climatic and energy measurement periods coincide.
- Make sure the meter reader is trained and train more than one person.
- Ensure that degree-day information is collected as soon as available.

#### Record

- Only collect data that will be used.
- Use simple straightforward forms.
- Perform simple checks to test data quality and validity.
- Read the meters at the same time each day/week/month.
- Use familiar units for energy and production.

#### Analyse

- When setting standards ensure that derived relationships are reasonable.
- Analyse the data for each time period, as it is available.
- Use spreadsheets and PCs for simple analysis.
- Use 'budget energy cost' to avoid distortions from fuel price changes.
- Keep analysis simple to meet the needs of the company.
- Integrate the process with existing systems.
- Issue reports in a timely fashion.
- Do not overload people with unnecessary information.

#### Act

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- Discuss reports informally with the relevant staff after each time period.
- Agree future plans for each period.
- Encourage discussion about future energy savings.
- Include energy in other management information discussions (e.g., team briefings).
- Motivate to encourage action rather than reaction.