Environmental Issues Series

Environmental Management Tools for SMEs: A Handbook

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Note
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Foreword

Environmental Management Tools for SMEs

The European Environment Agency exists to provide "targeted, timely, relevant and reliable information" to policy makers and others responsible for environmental improvement. It specializes, in conjunction with the European Information and Observation Network (EIONET), in the networked collection, analysis and distribution of environmental information. The Agency is currently addressing the issue of reaching small and medium-sized enterprises (SMEs) with appropriate products and services.

The relative contribution of SMEs to the total industrial environmental impact is unknown, but it is likely to be considerable, given their contribution to total production and their dominance in sectors such as metals, printing, textiles etc. About 80-90% of all enterprises in the EU are SMEs.

However, the role of SMEs in protecting and improving the environment, through their production and marketing of environmental technologies (for energy efficiency, waste minimisation, renewable energy etc.), is likely to be significant. And the *future* contribution of SMEs to improving society's "eco-efficiency", through innovation is also likely to be substantial, given the leading role of SMEs in general innovation and their flexibility.

Most SMEs perceive environmental improvement as a costly burden. As they are primarily concerned with short-term economic survival, they are not motivated to ask for, or use, environmental information or support. However, it is clear from the environmental technologies supplied by some SMEs, and the substantial gains (both financial and environmental) made by the few SMEs who have adopted "clean production", that action on their environmental performance can be an opportunity for many SMEs to improve their market share and profitability.

SMEs need four types of information:

- help and advice with environmental problems, concerning compliance, etc., and their solutions;
- tools for better environmental management (and general management);
- "success stories" and experiences that are specific to their sector;
- trends and scenarios about future marketing opportunities.

This product tries to meet the need of information about management tools, success stories and other experiences. It is also a gateway to other products and services within the EEA programme "EnviroWindows" describing the tools: Life Cycle Analysis, Environmental Risk Assessment and Clean Production.

The Agency thinks that the role of *local intermediaries* to deliver "reliable" information is crucial. The particular role of intermediaries can vary from *facilitator*, to *information provider* or *service provider*, to *regulator* and others such as local authorities. Other effective intermediaries are supply and purchasing chains, and business associations.

This product, "Environmental Management Tools for SMEs", prepared by Richard Starkey, Huddersfield University, UK, focuses on three questions:

- What is environmental management?
- Why should SMEs use it?
- How is the tool used?

We think the primary readers of this product are advanced SMEs and intermediaries, together with those in education and training.

Development and completion of this publication has involved many contributors other than the author. The report has been reviewed by the National Focal Points and the Scientific Committee of the EEA. The EEA is grateful for all these comments.

The EEA hopes that this publication will prove useful to its readers in increasing the environmental performance of SMEs.

Domingo Jiménez-Beltrán
Executive Director
European Environment Agency

1. Introduction

This is a handbook on environmental management tools for small and medium-sized enterprises (SMEs). Each of the following chapters is based around 3 questions:

What...? Why...? How...?

Chapter 2 is an introduction to the subject of environmental management and answers the questions:

- **What** *is environmental management?*
- **Why** *should SMEs undertake it?*
- **How** *should SMEs go about doing it?*

To undertake any task one needs to use appropriate tools. Chapter 3 and the subsequent chapters look at the environmental management tools available to SMEs that wish to effectively manage their environmental affairs. Each chapter deals with a specific management tool and answers the questions:

- **What** *is the management tool?*
- **Why** *should SMEs use it?*
- **How** *is the tool used?*

The tools covered in this handbook are:

- environmental policies
- environmental management systems
- environmental auditing
- environmental indicators
- ecobalances
- life cycle assessment
- environmental labelling
- environmental reporting
- environmental charters

1.1. What is an SME?

Given that this is a handbook for SMEs, we should define what exactly an SME is. The European Union (EU) has recently defined an SME as an enterprise which:

- has fewer than 250 employees;
- I. has either
  ⇒ an annual turnover not exceeding ECU 40 million, or
  ⇒ an annual balance-sheet total not exceeding ECU 27 million;
- is less than 25% owned by a non-SME

A *small* enterprise is one which:

- has fewer than 50 employees;
- has either
  ⇒ an annual turnover not exceeding ECU 7 million, or
  ⇒ an annual balance-sheet total not exceeding ECU 5 million.
- is less than 25% owned by a company falling outside the definition of *small*.

A *micro* enterprise is one which has fewer than 10 employees.

Box 1.1 What characteristics distinguish SMEs from other firms?

- *Lack of dominant market position*
  According to the EU, companies with 250 or more employees often have very strong market positions whereas companies with less that 250 employees tend not to hold a dominant position in their market.

- *Less well defined management structures*
  In addition, firms with more than 250 employees often possess very well defined management structures in the fields of production, sales, marketing, research and personnel management. In contrast, management structures tend to be less well defined in firms with less that 250 employees, which are often family-owned and where management is often carried out by the owners.

- *No support from a parent company*
  And of course SMEs do not have access to the funds and assistance that are often available to similar-sized firms that are owned by larger organizations.

How many SMEs are there in the EU?

As the above SME definition is relatively new, most member states do not yet have data based on this definition. However, every member state categorizes enterprises by number of employees. Table 1.1 shows the percentage of enterprises in the EU by number of employees and the contribution to total employment that these enterprises make.

No of employees	% enterprises	% employment
<250	99.8	66.4
50-249	*0.9*	*15.1*
10-49	*6.3*	*18.9*
0-9	*92.5*	*32.4*
=250	0.2	33.6

Table 1.1 percentage of enterprises in EU by number of employees and their contribution to employment

It can be seen that virtually all enterprises within the EU have less than 250 employees and that a massive 92.5% of enterprises are, in fact, micro enterprises. Of those enterprises with less than 250 employees, only a very few will not meet the SME turnover/balance sheet criteria set out above and it is estimated that between 10% and 20% of these companies will not meet the

ownership criteria (i.e. 25% or more owned by a non-SME). Hence we can say that

approximately 80-90% of all enterprises in the EU are SMEs

1.2. Reasons for reading this handbook

Written specifically for SMEs
Although they make up the vast majority of firms within the EU, to date there has been relatively little information on environmental management produced specially for SMEs. This handbook has been written specifically with SMEs in mind and aims to provide information relevant to both the smallest *micro* firm and the largest *medium* firm.

Most large companies have some knowledge and experience of environmental management and often have the resources to employ an environmental manager or even an environmental management team. In contrast, SMEs often lack information in this area and responsibility for environmental issues usually lies with busy staff who also have a number of other responsibilities. This handbook has therefore been written as an *brief* introduction to the various environmental management tools for managers who do not have vast amounts of time to devote to the subject. It assumes little or no knowledge and has been written in a straightforward and jargon-free style. Technical terminology has been kept to a minimum and when used, is explained in easy-to-understand language. The case studies used in this handbook are, wherever possible, case studies of SMEs.

.....and what if my company is not strictly an SME?
If your company has slightly more than 250 employees, a turnover of slightly over ECU 40 million or is not independently owned, don't worry - you can still use this handbook!!! The handbook is relevant to any firm that considers itself to be an SME-type firm or indeed to any firm that requires a brief introduction to environmental management tools.

A good source of further information
This handbook does not aim to cover every aspect of environmental management in exhaustive detail. To do so would make it many times thicker and would probably ensure that no-one would read it!!! Instead it aims to provide a solid introduction to the various environmental management tools and sources of further information for those companies that want to take things further.

1.3. How should the handbook be used?

The chapters in this handbook have been written as "stand-alone chapters" and so do not have to be read in order. However, if you are new to environmental management we suggest that you read the chapters in order as this will provide you with a systematic introduction to the management tools.

Chapter 2 introduces the subject of environmental management and provides an overview of the various environmental management tools described in this handbook.

Chapter 3 deals with what is often a firm's first step down the environmental management road - writing an environmental policy.

One of the tools that can used to realize the aims set out in an environmental policy is an environmental management system, dealt with in ***Chapter 4***.

Chapters 5 deals with environmental auditing. Environmental auditing is useful in many contexts and plays an important role in the successful functioning of an environmental management system.

Chapters 6 and 7 deal with environmental indicators and ecobalances. Not only are they both useful tools in their own right but they can be effectively used within an environmental management system.

Whilst the tools described in Chapters 4 to 7 relate both to *processes and products,* life cycle assessment and environmental labelling, the subjects of ***Chapters 8 and 9***, are tools that relate specifically to products.

Having put environmental management tools to use, a firm may want to communicates to its stakeholders the changes in its environmental performance that their use has brought about. Communicating environmental performance is dealt with in ***Chapter 10*** on environmental reporting.

And finally, ***Chapter 11*** looks at various environmental management charters that firms can to sign up to.

2. Environmental Management

2.1. What is environmental management?

Environmental management is management of those activities of a firm that have or can have an impact on the environment.

Business activity has a substantial impact on the environment.

- The manufacture of products involves extracting raw materials from the environment and processing them to produce saleable items. As a result of the production process, various forms of waste (solid, liquid and gaseous) enter the environment.
- The activities surrounding the manufacturing process - such as maintenance of plant and infrastructure and the packaging and transport of goods - all have environmental impacts.
- In addition, the products that are produced will eventually be disposed of and enter the environment as waste.
- The provision of services also results in a significant environmental impact. Service companies use various products and also energy to deliver their services, both of which result in waste entering the environment.

Put simply the environment acts as a *source* of raw material inputs to the industrial process and as a *sink* for its waste outputs. This relationship between business and the environment is shown in Figure 2.1.

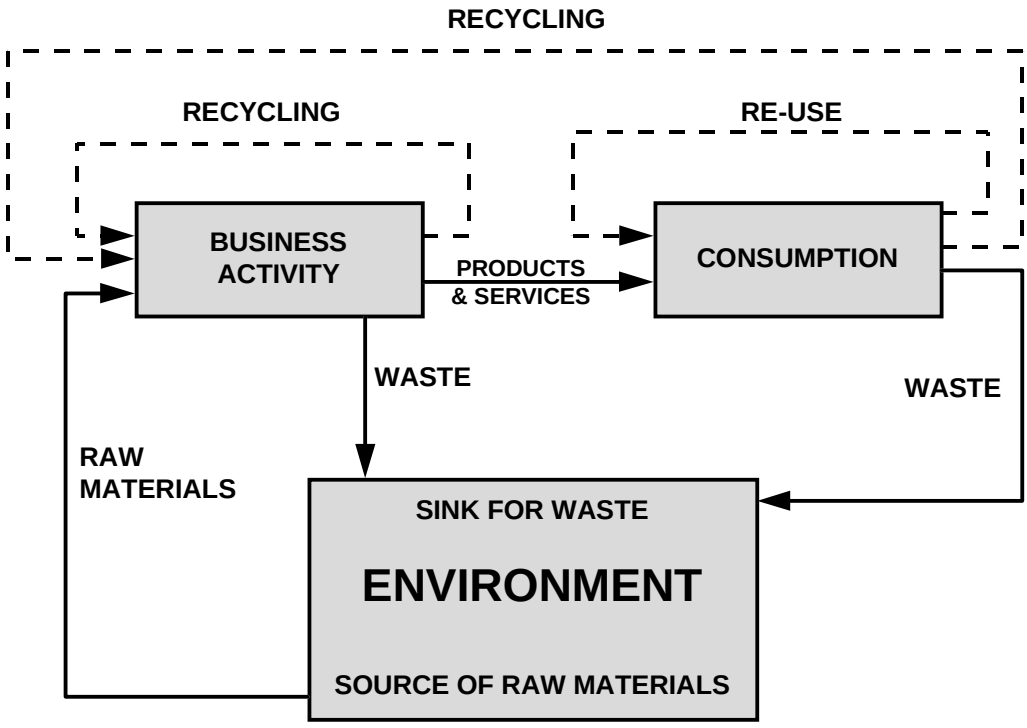

Figure 2.1 The relationship between business and the environment

Although all firms produce waste, not all firms extract raw materials from the environment. This is done only by those firms at the beginning of the supply chain. These raw materials are then processed in various ways as they move along the supply chain. Eventually products emerge and are distributed to wholesalers and retailers. This link between the environment and the supply chain is shown in Figure 2.2.

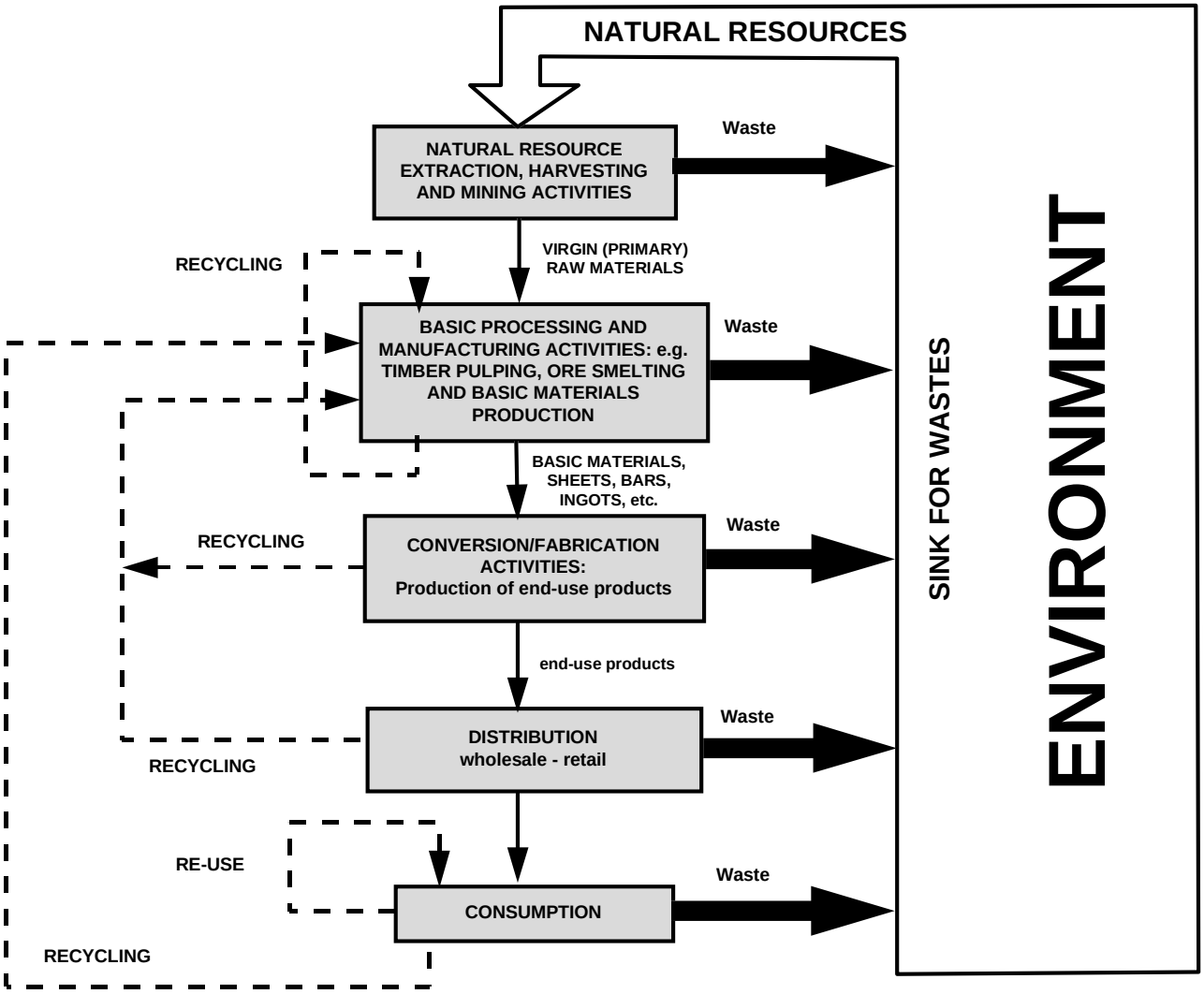

Figure 2.2 The supply chain and the environment[i]

By over-extracting raw materials from the environment and by overloading it with waste, the environment becomes degraded. Environmental management aims to find ways of carrying out business activities that reduce or halt this degradation. By doing this we can enjoy a better environment and make sure we preserve it for future generations.

[i] Adapted from Turner et al (1994) *Environmental economics: an elementary introduction*, Harvester Wheatsheaf. Reproduced with the permission of Prentice Hall.

2.2. Why undertake environmental management?

There are a number of business advantages to undertaking environmental management. The central message of this handbook is that:

ENVIRONMENTAL MANAGEMENT MAKES GOOD BUSINESS SENSE

IMPROVING YOUR ENVIRONMENTAL PERFORMANCE CAN IMPROVE YOUR BUSINESS PERFORMANCE

There are a number of advantages to undertaking environmental management and these include:

I Cost savings
II Ensuring legislative compliance
III Anticipating future legislation
IV Reduced environmental risk
V Meeting supply chain requirements
VI Improved relations with regulators
VII Improved public image
VIII Increased market opportunities
IX Employee enthusiasm

Each of these benefits is now examined below:

I Cost savings

Most, if not all people, wish to protect the environment. However, many SMEs fear that protecting the environment by improving their environmental performance will cost money. They fear there will be a conflict between their desire to protect the environment and their desire to keep down costs and run a successful business.

The good news is that many SMEs have discovered that far from increasing costs, ***improving environmental performance actually reduces costs.***

MANY COMPANIES HAVE FOUND THAT IT IS POSSIBLE TO SAVE MONEY, SOMETIMES LARGE SUMS OF MONEY, BY IMPROVING THEIR ENVIRONMENTAL PERFORMANCE.

Figure 2.3 shows material and energy flow through a firm. Cost savings within a firm can be achieved through changes in areas such as:

i process efficiency
ii product design
iii waste disposal
iv sourcing of raw materials
v infrastructure
vi packaging and transport

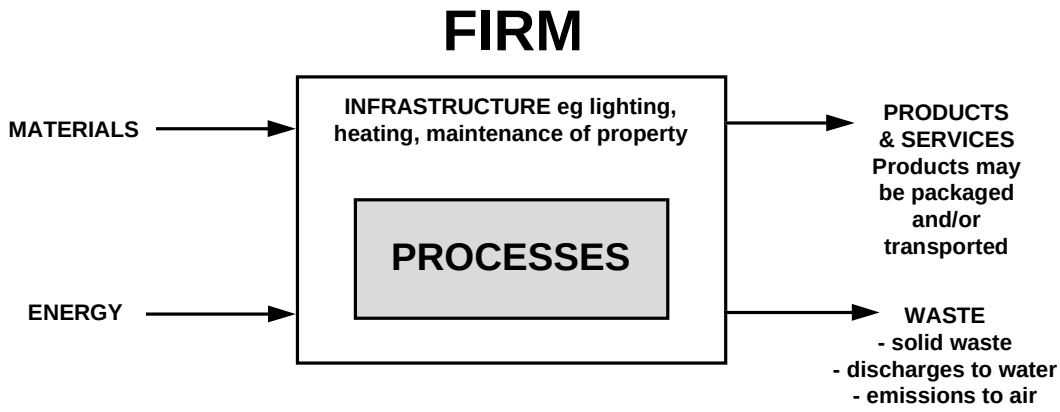

Figure 2.3 Material and energy flow through a firm

Various ways of achieving cost savings are described briefly below and demonstrated using case studies from the UK. Note that the ***ALL*** the companies in the following case studies are SMEs. If these companies can improve their business performance by improving their environmental performance then perhaps your company can too!

i Process efficiency

Improving the efficiency of existing processes
Optimizing the performance of existing processes minimizes the use of raw materials and energy and the production of waste. Reduced use of raw materials and energy and reduced waste production are all good for the environment and the reduced resource costs and waste disposal costs are good for business. Proper maintenance of equipment is important as it minimizes costly downtime and the resource waste often associated with shutdown and start-up periods.

Introducing more efficient processes
Introducing new and more efficient processes also reduces resource use and waste production. Many companies have been able to make large cost savings by reducing the amount of raw materials, energy and water that they use.

Raw materials
Skippingdale's new production technique meant that more of their raw material was incorporated in its product and far less ended up as waste - reducing both raw material and waste disposal costs.

Case Study 2.1 - Skippingdale Paper Products Ltd[ii]

Skippingdale Paper Products Ltd of Scunthorpe manufactures disposable nappies. The nappy absorption pads used to be cut with high pressure water jets which not only consumed large quantities of water but also dragged pulp fibres from the pad. The resultant water and fibre slurry was sent to landfill. By switching to moulding instead of cutting, Skippingdale no longer needed the water jets. Slurry, which used to amount to 5 tonnes per day, is no longer produced, saving £20,000 per year in landfill costs. By finding ways to use its raw materials more efficiently, Skippingdale not only reduced its waste disposal costs but substantially reduced the amount it needed to spend on purchasing pulp (see Case Study 2.4).

Water

In addition to showing how Goldrite was able to massively reduce its water consumption, this case study is also another good example of raw material savings.

Case Study 2.2 Goldrite Metal Finishing Ltd[iii]

Goldrite Metal Finishing Ltd electroplates metal and plastic plumbing components and bathroom fittings with a number of surface coatings including chromium, nickel, copper and gold. The company is based in Sheffield, employs about 50 people and had a turnover of £1.5 million in 1994.

The water used to rinse plating chemicals off components contains heavy metals and other toxic substances. Historically, Goldrite had disposed of this rinse water by discharging it to drain. The company had always been able to comply with its discharge consent limits, but in 1992 the local water company set much stricter limits for the discharge of effluent from the company premises. Possible treatment methods for the contaminated rinse water were therefore evaluated. Counter-current rinsing combined with evaporative recovery of the chemicals within the rinse water was considered the most cost-effective method of meeting these new consent limits. Counter-current rinsing involves cascading rinse water through rinse tanks in the opposite direction to that in which the rinsed component is travelling and can reduce water consumption by over 90% compared with conventional rinsing methods. The reduced volume of rinse water that results from this process is then put through an evaporator where water is evaporated off leaving a concentrated solution of process chemicals which can then be returned to the processing tanks. By introducing this new treatment method, Goldrite reduced the amount of water needed for rinsing, reduced the quantity of process chemicals needed and eliminated the need for expensive end-of-pipe effluent treatment.

The introduction of counter-current rinsing and evaporative recovery led to

- a 70 % reduction in water use, resulting in annual savings of £2,805 in supply charges and £820 in trade effluent disposal charges.
- a 60% reduction in the quantity of chemicals consumed per square metre of plating, a saving of £11,310/year

Additional running costs resulting from the process changes came to £1,635/year resulting in annual cost savings totalled £13,300. The capital costs involved came to £31,450 giving a payback period of 2.4 years

[iiii] Hill et al (1994) *Benefiting Business and the Environment*, Institute of Business Ethics

[iiiii] Case Study NC11, UK Environmental Technology Best Practice Programme

energy

Case Study 2.3 Lesterdale Ltd[iv]

Lesterdale are specialist manufacturers of fusible interlinings which are interwoven into jackets and shirt collars to stiffen them. The process involves heating the fabric to 180C in an oven in order to melt a polythene powder onto the linings. The existing system was outdated, running inefficiently with little temperature control. Only certain materials could be used, which limited the range of products and therefore the company's potential.

Lesterdale decided to modify their existing ovens by installing medium wave infra-red heaters. These modifications have reduced energy use and production costs, the payback time on the infra-red units being six months. In addition the new units have improved product quality. The system provides consistent heat and is highly controllable and this has led to the elimination of rejects. The increased control and heating zone of the new system has increased the range of fabrics and resin which can be used thereby expanding product range. And the 2 minute warm up time allows production to start straight away increasing production rates.

The installation of this equipment has been a great success, improving the company's business performance and allowing them to increase their exports.

ii Product design

It may be possible to redesign a product so as to reduce the amount of resources it contains whilst still maintaining the level of service it provides.

Case Study 2.4 - Skippingdale Paper Products Ltd

By redesigning their nappies so as to eliminate unnecessary padding and by adopting the moulding technique mentioned above, Skippingdale have made a massive annual saving on pulp costs of £800,000.

iii Waste disposal - making money from waste

As mentioned above, improving process efficiency will reduce the amount of waste that a process produces. Once waste has been generated, it is often possible to reuse it or pass it on to other companies that can use it and so avoid the costs of waste disposal. Holdene PLC have managed to do both.

Case Study 2.5 Holdene PLC[v]

Holdene PLC is a computer system resellers with offices in Leeds, Harlow and Scarborough. The company designs, installs and maintains integrated computer systems; leases computing facilities; offers consultancy services and provides tutored courses in micro-computing and business skills. By dealing with its waste more effectively Holdene has been able to save considerable sums of money. Note that the savings described below were achieved with no investment other than staff time.

General Packaging - Up to 99% of the polystyrene chip foam that comes into the company is reused. The annual saving resulting from not having to pay for disposal of the packaging and from not having to buy in new packaging is estimated to be around £20,000.

[iv] Case Study, 1994 PEP Awards, Norweb, UK

[v] Case Study, Leeds Environmental Business Forum, UK

Electro Static Device (ESD) Packaging - Holdene packages its components in ESD packaging in order to comply with the British Standard on the handling of electro static devices. Many of the incoming components are contained in such packaging. None of this is thrown away - it is all reused. Holdene reuses 100 static envelopes/week. Reusing these envelopes rather than purchasing new ones at £0.50 each results in a saving of £2,600/year. Similarly Holdene reuses 100 boxes/week. Reuse, rather than purchasing new boxes at £1.50 each, means a saving of £7,800/year.

Paper Waste - Holdene now separates paper waste from its household waste stream. Prior to separating its paper, Holdene paid around £85/month to dispose of it. However, it is now collected at a cost of £40/month by a company that sells the paper on to the recycling industry. This has resulted in annual savings of £525/year.

Computer waste - Previously, old or damaged electronic waste was carefully packaged and sent for disposal at a landfill site. 2 skip loads per year were disposed of at a cost of £85/year. This money is now saved as the computer waste is now collected free of charge by a company that recovers precious metals from the waste and sells them on to the recycling industry and the electronic equipment industry.

Aluminium cans - Holdene collects aluminium cans which it sells to the can company Alcan for recycling. The revenue from the sale (£20/year) when added to savings from no longer having to pay for the disposal of 2 skip loads of cans (£85/year) generates a total saving of £105/year.

iv Sourcing of raw materials

Changing the source of raw materials used in a particular process can result in cost savings. Evergreen made large savings by using recycled wool rather than virgin wool to manufacture its products.

Case Study 2.6 - Evergreen[vi]

Evergreen is a small, privately owned Bradford-based company that has developed a range of yarns, fabrics and finished products using a high proportion of recycled wool fibre.

Although natural textile fibres such as wool are considered more environmentally friendly than their synthetic counterparts, the production and transportation of wool and its processing into a finished garment consume relatively large amounts of energy. However by using recycled fibre rather than new wool, a large proportion of this energy is saved as the recycled waste has already undergone several of the most energy-intensive processes and these do not need to be repeated. As well as the energy savings, other cost savings can be achieved because of the lower price paid for recycled fibre in comparison with new fibre.

The cost saving arising from the reduced amount of energy used in processing recycled fibre as opposed to new wool is £0.20/Kg. The cheaper price of purchasing recycled fibre and the fact that there are no dyeing costs (it is already dyed) means additional savings of £2.75/Kg. In 1992 total savings resulting from reduced energy use and the cheaper price of the recycled wool amounted to £297,860.

Using recycled wool has other significant environmental benefits. Fresh water consumption and effluent production are greatly reduced because processes such

[vi] Good Practice Case Study 295, Energy Efficiency Office, Department of the Environment, UK

as raw wool scouring and dyeing do not need to take place. Old woollen garments are usually dumped in landfill sites where they decompose to produce methane, a gas that contributes to the climate change. Recycling wool means that this methane production is avoided.

v Infrastructure

It is also possible to make savings by making efficiency changes to your infrastructure e.g. installing energy efficient lighting, insulating buildings, improving the efficiency of heating systems. By improving the efficiency of its heating system, J W Arrowsmith made substantial savings.

Case Study 2.7 J W Arrowsmith Ltd[vii]

Following an energy efficiency survey of the heating system in its 1954 factory, Bristol printer J W Arrowsmith Ltd decided to replace it with new decentralized space heating arrangements and an independent heating system for domestic hot water. As a direct result of these changes, building related energy consumption (corrected for the effect of the weather) was cut by 50% from 3 to 1.5 million kWh per year. This gave a 47% reduction in fuel cost, worth about £24,000 per year, and related maintenance costs were reduced by over £2,000. The total cost of the works came to £47,250, so the simple payback on investment was 2 years. However, the company chose to fund the scheme through a finance lease arrangement with a bank. Under this arrangement the annual fuel cost savings were substantially greater than the annual rental payments, generating a positive cash flow within the first full year of operation.

vi Packaging and transport

Once goods have been produced, they need to be packaged and transported. It is possible to make cost savings in these areas at the same time as improving environmental performance.

Case Study 2.8 Skippingdale Paper Products Ltd

Through compaction and the improved design of its nappies (see above), Skippingdale has reduced the volume of disposable nappy packs by almost 60%. As more nappies can be fitted into a lorry the number of lorry loads needed to deliver the nappies has been reduced. This has resulted in a reduction of 600,000km/year travelled by delivery lorries which represents an annual saving of £195,000. The new compaction packaging equipment, designed by Skippingdale, paid for itself in 6 months.

The reduction in packaging volume has had knock-on benefits for Skippingdale's customers as its Managing Director explains: "*We deliver to depots from where our customers distribute to their individual shops. So not only do we save on transportation costs ourselves, but our customers also make savings.*"

And to show that the companies described in the case studies above are not exceptional cases, we finish this section on cost savings by highlighting the work of the Groundwork Trust.

Case Study 2.9 The Groundwork Trust[viii]

[vii] Good Practice Case Study 181, Energy Efficiency Office, Department of the Environment, UK
[viii] Hillary, R (1995) *Small Firms and the Environment: A Groundwork Status Report*, Groundwork

The Groundwork Trust is an organization that works closely on environmental issues with many SMEs throughout the UK. One service it offers is helping SMEs to carry out a review of their environmental activities. **Groundwork calculates that the average savings resulting from actions highlighted by an environmental review is £9,000**.

As well as cost savings, other advantages of undertaking environmental management include:

II Ensuring legislative compliance

By ensuring that it complies with relevant environmental legislation, a firm can avoid the possibility of being fined by the regulatory authorities for non-compliance and the adverse media publicity that can accompany such fines.

III Anticipating future legislation

Developing an awareness of likely changes in environmental legislation allows firms to plan for these changes and make appropriate investment decisions. If a firm is not aware of proposed legislation it may make investments that it then finds are not appropriate if and when the new legislation is enacted. Alternatively, a firm may find out about a legislative change at the last minute and be forced to undertake rapid investment to comply with its requirements. Prior knowledge of likely changes allows a longer time period over which to make the necessary investment and prevents possible cash flow problems. By responding creatively to the upcoming EU Packaging Directive, SA Labels gained a number of business advantages.

Case Study 2.10 SA Labels[ix]

SA Labels, a small manufacturer of adhesive labels based in Keighley, West Yorkshire had identified as early as 1993 that the then proposed EU Packaging Directive, could have major consequences on its business. (The Packaging Directive requires manufacturers and retailers to take responsibility for the packaging that they use/handle. Whilst they do not have to chase their packaging round the country in order to recover it, they do have certain recycling and recovery targets to meet. These targets will ensure that the vast majority of packaging is collected and recycled).

The company felt that as its labels appeared on packaging such as plastic bottles, the labels themselves might be classified as packaging and so be covered by the legislation. In the case of plastic bottles, the compatibility of labels attached to them suddenly became an issue - a compatible label would aid recycling as it would not have to be removed from the bottle. The company also realized that the compatibility of the bottle top or closure with the rest of the bottle was also likely to be an issue.

This forward thinking encouraged SA Labels to draw together the entire supply chain for a particular product for which they supplied labels - a washing detergent bottle - everyone from the plastic granulater to the supermarket that sold the detergent. The group that got together set out to redesign the bottle within the constraints set by the Packaging Directive. The aim was to design a bottle that could be recycled as one

[ix] Case study prepared by Mark Shayler of Bradford Business Link

unit i.e. no separation of label or closure necessary. After months of planning this aim was achieved and the new bottle launched. The new bottle had a compatible closure and label and is therefore a major aid to economically viable recycling. The bottle's label is 15% lighter than its predecessor and the bottle itself is made from 35% post consumer waste.

The company has achieved a number of non-environmental benefits. First, they have received an enormous amount of positive publicity in their own trade press. Secondly by initiating such a wide-ranging and innovative supply chain project, they have gained a great deal of respect from their own supply chain. Thirdly, the project has had knock-on financial benefits as the redesign of the product has allowed for cost reductions at a number of stages along the supply chain.

IV Reduced environmental risk

Environmental risk is the single largest hidden risk for many companies. By undertaking environmental risk assessment as part of the environmental management process it is possible to reduce the risk of the occurrence of events that could have adverse environmental consequences.

Banks, insurance companies and investors all base their decisions on an assessment of risk. The higher the risk, the less likely a bank is to lend, the less likely investors are to invest and the higher insurance premiums are likely to be. Therefore a reduction in environmental risk is likely to be viewed favourably by all these parties, putting a firm in a better position to obtain loans and insurance cover and to attract investment.

V Meeting supply chain requirements

An increasing number of large organizations are requiring their suppliers to demonstrate sound environmental management and are prepared to delist those that fail to do so. In some cases having an environmental policy is not considered sufficient proof of sound management and evidence is required that a firm is taking action to meet the commitments set out in their policies. Hence, undertaking effective environmental management will increasingly be necessary to gain or maintain supplier status with large organizations.

The following case study shows the standards B&Q, a large UK home improvements and garden centre retailer, sets for its suppliers in relation to their environmental management activities, and the assistance it offer to its suppliers to help them meet these standards. Note how B&Q has raised the standards it sets for its suppliers and how it has been prepared to delist suppliers who continually fail to meet them. In addition see Case Studies 3.1 and 3.2, which also illustrate the demands that large companies are placing on their suppliers.

Case Study 2.11 B&Q's Supplier Environmental Audit[x]

B&Q is the UK's biggest home improvement and garden centre retailer. It has 280 stores, employs 18,000 people and has a turnover of over £1 billion.

[xx] How Green is my Front Door?: B&Q's Second Environmental Report, 1995

In the 1990 accusations of irresponsible timber sourcing were made against the company by a number of environmental pressure groups. The company became aware that for the first time it was being held accountable for the environmental consequences of its purchasing and was forced to recognized that it had a poor understanding of the environmental impacts occurring at the sourcing end of its supply chains. If there was a problem with timber, what other problems might there be with the 40,000 other products it sold?

In response to this recognition, B&Q launched their Supplier Environmental Audit scheme (SEA) in December 1991. A 40 page questionnaire was sent out to all suppliers. Those returned were rated according to the supplier's awareness of the environmental issues related to their product(s), the existence of a corporate environmental policy, and action being taken to improve environmental performance.

The results of this survey released in February 1993 revealed that only 8% of suppliers had an environmental policy which demonstrated an understanding of their environmental issues and contained a commitment to taking action to improve their environmental performance. A further 38% had taken steps to identify environmental issues but had not followed them up in any systematic way. 29% had not taken any action at all and 25% had not even completed the questionnaire.

The challenge for B&Q was to use the information to bring about improvements in supplier performance and so reduce its own environmental impact. In 1993 the questionnaire was repeated in the form of an 8 page update and suppliers were encouraged to describe their environmental performance in their own words. However this approach was hampered by B&Q's discovery that many of its suppliers didn't know what their environmental impacts were, let alone how to deal with them.

One of B&Q's responses to this problem was to send out individual reports to each of its suppliers. The two-page reports - based on information contained in the questionnaires and obtained at meetings with the suppliers - summarized supplier performance in relation to a number of issues that were of particular importance to B&Q including timber, peat, overall environmental management, supplier auditing, packaging and waste. Although time consuming, the production of these reports was seen as an essential part of getting suppliers to understand their particular issues and subsequently to commit themselves to action.

The reports graded each supplier with a grade A-F. A, the highest grade, meant

suppliers demonstrate environmental excellence. A systematic, mature and well- documented environmental programme is in place. Suppliers have developed innovative responses to environmental issues.

Grade E meant

Suppliers have returned their questionnaire but expose B&Q to severe liability in one or more specific areas. Immediate action is required to address these issues.

F was the grade given to those suppliers who failed to return any of their SEA questionnaires.

In addition to issuing its reports, B&Q also ran a series of 12 seminars designed to provide an opportunity for suppliers to learn about environmental management and the overall significance of the environment, both to themselves and to B&Q.

Once completed the new set of supplier reports provided B&Q with a more accurate picture of its suppliers. In December 1993, 35% of suppliers had policies graded at C or above - B&Q's definition of an acceptable policy. Almost two-thirds of suppliers

failed to make the grade an it became clear to B&Q that for real progress to be made, the environment would have be made a commercial issue for suppliers. Hence in January 1994 the B&Q board put the environment firmly on the commercial agenda by setting two targets for the year. By June 30th all grade F suppliers had to achieve grade C and by November 30th all grade D or E suppliers also had to achieve this grade. Any suppliers who failed to meet their targets would face losing their business with B&Q.

Of the 29 companies that had failed to reach grade C by November 30th, eight gave valid reasons for their failure to do so and were granted an extension and 10 companies were delisted. The remaining companies were given a final chance as a result of their strategic importance to B&Q. All these companies have now reached an acceptable standard and are being closely monitored by B&Q's environment department. New suppliers are informed of B&Q's environmental requirements and given six months to reach grade C.

The SEA has brought about an enormous increase in the number of suppliers with an environmental policy, from 8% in 1992 to 97% in may 1995. However since July 1995 it has no longer acceptable for suppliers just to have an environmental policy making commitments to environmental improvement. They have also had to demonstrate they are taking concrete action to bring about the improvements to which they have committed themselves. Suppliers are now given two grades, one for their policy and their understanding of environmental issues and one for their environmental action. This means that suppliers are not able to hide behind the words of their policy without taking action. It also enables B&Q to recognize the achievements of suppliers who have taken some radical steps to reduce their impacts, but may have a weak or rather general policy statement.

VI Improved relations with regulators

The ability to demonstrate sound environmental management may lead to environmental regulators taking a more "hands-off" approach to regulation e.g. a reduction in the number inspection visits required per year. The following case study shows how the Bavarian Government have done just this, adopting a more "hands-off" approach with companies that undertake certain voluntary environmental management initiatives. See also Case Study 4.3 on the Dutch covenant system.

Case study 2.12 The Bavarian Environmental Agreement

The Bavarian Environmental Agreement, launched in 1995, is a voluntary agreement between the Bavarian Government and industry in the region which aims to increase the environmental performance of Bavarian industry. Bavarian industry has committed itself to a range of environmental projects which go beyond legislative requirements and in return the government has promised support and increased incentives for the companies undertaking these projects. The issues covered in the agreement include environmental management, waste management, energy management, renewable resources and traffic.

In the area of environmental management, Bavarian industry has committed itself to ensuring that 3,500 organizations conduct environmental reviews. In addition it will ensure that 500 industrial sites are registered under EMAS - the EC eco-management and audit scheme (described in Chapter 4). In return, the government has promised to free companies which are registered under EMAS from various reporting, documentation and control requirements.

VII Improved public image and community relations

By publicizing its efforts to improve environmental performance, a firm can improve its public image, thereby enhancing its position in the market place. And by demonstrating sound environmental management, a firm can reassure the local community about its activities and thus build up good community relations.

VIII Increased market opportunities

Lower production costs resulting from environmental management, and good public image resulting from publicizing good environmental performance can result in a firm increasing sales and gaining a larger market share. Loudwater, a small printer based in Watford, UK, has recently become registered under EMAS, the EC eco-management and audit scheme (explained in Chapter 4) and has gained a great deal of new business as a result. As Loudwater's Managing Director says[xi]

> "*We are winning new business all the time, particularly from blue-chip companies which previously would not have considered us. The fact that we can prove our green credentials through EMAS and demonstrate our ability to work within the framework of environmental legislation in a wider Europe gives us that competitive edge*". (For more details on Loudwater see Case Study 4.4)

IX Employee enthusiasm

The environment is an issue about which many people are concerned. Undertaking environmental management can generate a lot of enthusiasm within a firm as it allows employees to express their environmental concern in a practical way by contributing towards improving environmental performance. As one manager put it - his company's environmental management system (see Chapter 4) motivates his employees a lot more than its quality management system! The introduction of an environmental management system at Wolstenholme International Ltd (see Case Study 4.1) led to employees setting up a voluntary "Green Group" to carry out conservation activities in the local community.

2.2.1. Why don't SMEs undertake environmental management?

Given the many benefits that can result from undertaking environmental management, why is it that so few SMEs have started to do it? What holds SMEs back?

Those who work with SMEs on environmental issues report the same findings again and again. SMEs do not undertake environmental management as they feel that they have neither the time nor the money to do so. SMEs often have to concentrate their efforts on matters of day-to-day survival such as paying bills, providing weekly pay packets and keeping orders coming in. Environmental management requires time to implement and money to undertake, time and money which SMEs feel they do not have available. ***In short environmental management is seen as a luxury that SMEs cannot afford.***

[xi] Case Study 1, UK Competent Body for EMAS, Department of the Environment

Overcoming the barriers to environmental management

Undoubtedly environmental management has a cost - both in terms of time and money. However what this chapter (and indeed the whole handbook) aims to show is that

THERE ARE MANY OPPORTUNITIES FOR ENVIRONMENTAL MANAGEMENT WHERE THE BENEFITS SUBSTANTIALLY OUTWEIGH THE COSTS.

Given that there is likely to be the increasing stakeholder pressure on firms to demonstrate sound environmental performance and given the many benefits that it can bring, environmental management should be seen not as a luxury that SMEs can't afford ***but as a necessity that they will find it increasingly difficult to do without.***

2.3. How does my firm go about environmental management?

Hopefully, by now you'll agree that environmental management is worth investigating. If that's the case then your company will need to know how to go about it. To undertake any task one needs appropriate tools. This handbook describes a range of environmental management tools - tools that your company can use to effectively manage its environmental affairs.

In the early 1990s the International Organization for Standardization (ISO) recognized the need for standardization in the field of environmental management tools and in 1993 it set up a committee to write standards relating to the following 5 environmental management tools:

- environmental management systems
- environmental auditing
- environmental labelling
- life cycle assessment
- environmental indicators

This handbook describes the **What...?, Why...?** and **How...?** of these tools and of four further tools:

- environmental policies
- ecobalances
- environmental reporting
- environmental charters

By reading the chapters on the above tools your firm will be able to gain an understanding of what tool or tools would be the most appropriate to use. To introduce these tool, each is described briefly below.

- **Environmental policy (Chapter 3)**
  An environmental policy is a document which clearly sets out the overall aims and intentions of a firm with respect to the environment. Developing an environmental policy is often the first step taken by firms who wish to undertake environmental management. An environmental policy signals a

commitment to environmental management and can prepare the way for further environmental management activities. One tool that a firm can use to realize the aims and intentions contained in its policy is an environmental management system.

- **Environmental management systems (Chapter 4)**
  An environmental management system (EMS) enables a firm to manage its environmental affairs in a planned and systematic way and thus identify those ways of improving its environmental performance that most benefit its business performance. This chapter focuses on the requirements of two EMS schemes: 1) ISO 14001, the international environmental management system standard and 2) EMAS, the European Community's eco-management and audit scheme. (**Note**: It is highly likely that in the future ISO 14001 and EMAS will come to be the key tools in the field of environmental management.)

  In order to develop an EMS that meets the requirements of these schemes a firm must take the following steps.

  1. First it must produce an environmental policy that contains commitments to legislative compliance and to continually improving its environmental performance.
  2. Next it must set targets relating to these commitments and devise a programme for meeting these targets. Targets for improving environmental performance should be based on a comprehensive review of its environmental activities.
  3. It must then take the measures necessary to implement the programme.
  4. Having implemented the programme, it needs to check that it has been successful in meeting its targets. Corrective action must be taken in instances where this is not the case. The EMS must be audited periodically to check it is functioning as it should. (Auditing an EMS is covered in Chapter 5.)
  5. Finally, the firm needs to carry out a management review of the EMS, making any changes necessary in light of the audit results and changing circumstances. Having met its first set of targets the firm must set itself a new set of targets so as to meet its policy commitment to continual improvement.

- **Environmental auditing (Chapter 5)**
  Environmental auditing is a tool for checking whether a firm is doing what it should be doing. For instance a legislative compliance audit checks that those activities of the firm covered by environmental legislation (i.e. what it is doing) actually comply with that legislation (i.e. what it should be doing). An environmental audit will tell a firm whether its waste management practices (i.e. what it is doing) conform with the industry sector best practice guidelines it has committed itself to following (i.e. what it should be doing).

  Auditing is an important part of an environmental management system. ISO 14001 requires that an audit to be undertaken to check whether a firm's EMS meets its requirements and the same is true for EMAS. Given the

importance of environmental management systems, a detailed explanation of the EMS audit process is given in this chapter.

- **Environmental indicators (Chapter 6)**
  Environmental indicators allow a firm to measure both its environmental performance and its efforts to improve its performance. Indicators can be used within an environmental management system to check that a firm has met the targets it is required to set for itself, but can equally well be used in firms that have not developed an EMS.

- **Ecobalance (Chapter 7)**
  A company ecobalance records the various raw materials, energy, resources, products and wastes entering, held within and leaving a company over a specified period of time. In other words, it provides a record of a company's physical inputs, stock and outputs. Once a company knows exactly what is coming in and going out, it can begin to assess the particular environmental impacts of those inputs and outputs. An ecobalance therefore enables a firm to undertake the comprehensive environmental review of its activities required by ISO 14001 and EMAS and to go on and set targets for improving its environmental performance.

Whilst the tools described in Chapters 4 to 7 relate to both *processes and products*, the tools described in Chapters 8 and 9, namely life cycle assessment and environmental labelling, relate specifically to *products*.

- **Life cycle assessment (Chapter 8)**
  Life cycle assessment (LCA) is a tool for identifying and assessing the various environmental impacts associated with a particular product. LCA takes a "*cradle to grave*" approach looking at the impacts of the product *throughout its life cycle* - i.e. from the raw materials acquisition (the "*cradle*") through its production and use to its final disposal (the "*grave*"). LCA allows manufacturers to find ways of cost-effectively reducing the environmental impact of a product over its life-cycle and to support their claims about the environmental impact of their products.

- **Environmental labelling (Chapter 9)**
  Environmental labelling schemes award an environmental label to those products that are judged to be less harmful to the environment than others within the same product group. Firms that wish for their products to be considered for a label must apply to the scheme organizer. To be awarded a label, a product has to meet a set of environmental criteria drawn up for its product group by the labelling scheme organizer. The criteria relate to the complete product life-cycle and are drawn up using LCA. They are set so that only a certain percentage of products within a group, say 20-30%, can meet them. Hence environmental labels can be used as marketing tools as they signify that a product is one of the least environmentally harmful products in its group.

- **Environmental reporting (Chapter 10)**
  Having undertaken various environmental management initiatives to improve its environmental performance, a firm may wish to communicate the results of these initiatives to the outside world. One way of doing this is

by publishing an environmental report. Issuing an environmental report can improve a firm's public image and lead to improved relationships with stakeholders. To date, it is mainly large companies that have issued such reports but SMEs may also find environmental reporting a useful tool.

- **Environmental charters (Chapter 11)**
  There are a number of environmental charters and guidelines to which a firm can subscribe in order to demonstrate its commitment to responsible environmental management. Information on various charters is discussed in Chapter 11.

2.3.1. How can a company make use of these tools?

If your firm wishes make use of these environmental management tools, it has a number of options. It can

- read the relevant literature on the tools
- get staff trained to use them
- use external experts

It is likely that many firms will find it most useful to use a combination of the above.

The *Further Information* sections at the end of each chapter refer to relevant literature. And as regards training, there are now an increasing number of environmental management training courses being run on the various management tools. Details on such courses can be obtained from sources such as trade associations, trade/environmental journals and your local business information centre.

The final part of this chapter gives advice on using the services of external experts.

Obtaining expert assistance

Free and low cost assistance

If you decide to use external experts you should thoroughly explore the options for obtaining free or low cost assistance. The following examples of free or low cost assistance come from the UK and Denmark.

Environmental business clubs

In the UK there are approximately 100 environmental business clubs that provide a number of free or low cost services to their members. These clubs are financed by a mixture of private, government and EU funding, and offer information, advice and guidance on environmental matters. Membership is often free and where charges are made they are minimal. The following table shows the services offered to members by environmental business clubs in the North Eastern region of the UK.

Club Name	Cleneland Wildlife Trust	Durham Business Environmental Action Group	Great North Environmental Campaign	Middlesborough Environment City	Newcastle Initiative Environmental Services	Productivity North East	Teeside Environmental Services	Wearside ACBE Local Initiative (WEAR)
Regular Meetings	X			X	X	X		X
Newsletter	X		X	X	X			X
Helpline		X	X			X		X
Other Information Services	X		X	X	X	X		X
Events / Seminars	X	X	X		X	X	X	X
Trainging Courses	X	X			X	X		X
Initiatives		X	X		X	X		X
Environmental Reviews	X	X		X	X		X	X
Other Environmental Services	X	X			X	X		X

Table 2.1 Services provided by Environmental Business Clubs - North East Region

The following case study shows how a small manufacturer of industrial hygiene products benefited from the assistance provided by an environmental business club.

Case Study 2.13 Mold Hygiene Chemicals Company Ltd[xii]

Mold Hygiene Chemicals Company Ltd manufactures cleansing liquids and other industrial hygiene products by blending aqueous-based formulations at ambient temperature. The company is based in Mold, North Wales, employs 45 staff and has a turnover of about £2.75 million.

The importance of environmental matters became critical when, in 1993, the company accounts showed a sharp rise in the charges for effluent disposal. The company faced a dilemma in that it could neither tolerate the high effluent charges nor justify the expense of external assistance to resolve the problem. The company therefore decided to look for an in-house solution and any free help that was available.

Around this time, Mold had become involved with the ARENA network, one of the environmental business clubs operating within the UK. As the result of attending a series of workshops run by the ARENA network, Mold decided to undertake a DIY environmental review with the support from network's consultants. The review revealed that not only was Mold paying higher effluent charges, but it was losing saleable product in the effluent. Furthermore additional costs were incurred neutralising the effluents prior to discharge. The review also revealed relatively high costs for general waste disposal.

As a result of the review a number of changes were implemented. Production processes and the sequence in which products were produced was changed. Cardboard was separated from the solid waste stream and free collection by a recycling company meant disposal charges were avoided. These changes along with changes in stock control procedures and pricing policy led to annual savings of £15,000. The cost of undertaking the review and implementing the improvements was mainly in management and staff time and was estimated to be £5,700, giving a payback time of just five months.

Environmental helpline

[xii] Case Study GC20, UK Environmental Technology Best Practice Programme

The UK government runs an environmental helpline as part of its Environmental Technology Best Practice Programme. The helpline can be called by any commercial organization and gives free, up-to-date information on a wide range of environmental issues, legislation and technology. In addition, for companies with fewer than 250 employees, the helpline provides a free consultancy service. In order to help these companies improve their environmental performance, environmental counselling visits can be arranged at the discretion of the helpline's manager. A specialist from the helpline's panel of 40 environmental professionals will visit a company site and provide half a day's advice and a practical follow-up report which is completely confidential.

Graduate students
Employing graduate students can provide a low cost source of assistance at the same time as providing valuable work experience for the student involved. Graduate students have been used by SMEs in Denmark through a scheme run by the Environmental Protection Agency.

Case Study 2.14 - Danish Environmental Protection Agency scheme for SMEs

In Denmark, the Environmental Protection Agency runs a scheme whereby it will fund 50% of the cost of SMEs employing a person to work on environmental management issues within the firm. This has led to a number of SMEs recruiting unemployed environmental science graduates. A number of SMEs have reported back to the Agency that they have achieved cost savings as a result of taking part in this scheme.

Hiring consultants
If your company decides to employ consultants it is important to ensure that you get the best service possible. If you have not hired consultants before the following simple advice may be helpful.

A good way to find a consultant is by personal recommendation. Other methods are through:

- your industry/trade association
- directories of consultants
- consultant's professional institutes or associations
- environmental business clubs
- environmental/trade journals
- your local business information centre

You can check the competency of a potential consultant by asking for information regarding:

- relevant experience with SMEs
- relevant experience in your industry
- qualifications of the individual consultants who would be undertaking the consultancy
- previous satisfied clients. You may want to contact previous clients personally to obtain references
- technical facilities available to conduct relevant measuring, monitoring, testing etc.

Note: You should also make sure that a potential consultant has appropriate Professional Indemnity Insurance.

To select your consultant you could take the following steps:

- list potential consultants
- prepare a shortlist using information from brochures, referrals or other criteria
- interview shortlisted consultants
- obtain proposals/price quotations from consultants favoured at interview
- re-interview where necessary to make sure
- select the best value for money proposal

To make the best use of your chosen consultant, you should:

- engage the consultant contractually
- brief the consultant on your firm, site, staff, etc.
- provide any information requested
- work with your consultant - don't just leave your consultant to it
- make sure you are given regular updates on the work being undertaken
- review a draft of the consultant's final report

It may be possible to negotiate a "payment-by-results" agreement with a consultant, such as the one negotiated by N T Frost.

Case Study 2.15 N T Frost[xiii]

N T Frost is a medium-sized electroplating company producing a wide variety of components for casting and pressing manufacturers. The company is located in the West Midlands, UK and employs around 80 people. Most stages of the electroplating process require large quantities of water for rinsing. The rinse water becomes contaminated, not only with the plating metals but also with process chemicals such as acids alkalis, and cyanides. The resulting effluent requires chemical treatment in order to meet the conditions set out in Frost's discharge consent.

In 1991 the factory's output reached a level that required more water for washing than could be delivered by the available supply. Rather than spend large sums of money increasing the water supply, Frost's management appointed consultants on a "payment-by-results" basis to review the company's use of water and to recommend improvements. Frost agreed to pay the consultants 50% of any water supply savings made during the first year, after deducting the cost of any necessary plant and equipment. After undertaking short-term monitoring to establish rinse water requirements, the consultants recommended a series of good housekeeping measures, including the installation of flow restrictors, flow-rate gauges and accumulator meters.

As a result of implementing the measures recommended by the consultants, Frost reduced their water consumption by 42% (60,000m^3) saving £36,410. As a result their effluent volumes fell by 41% leading to a reduction in effluent disposal costs of 33%, a saving of £11,260. The cost of treating the reduced volume of effluent rose by £2,860 and therefore the total saving came to £44,810. The projects costs, including the consultants' fee of £17,500 come to £24,000. Hence, Frost saved £20,810 in the year the project was undertaken and saves £44,100 each subsequent year.

[xiii] Case Study GC22, UK Environmental Technology Best Practice Programme

Further Information

Euro Info Centres (EICs)
The European Union has established a network of over 230 Euro Info Centres throughout the member states to provide information to business on all matters relating to its work. A number of these EICs have developed their expertize regarding environmental issues facing SMEs. The EICs in this specialized group on the environment can offer companies a variety of services including:

- information on environmental legislation and cleaner technologies
- identification of sources of EU funding
- company partner searches for business cooperation and for joint research an technological development
- environmental management seminars
- guidance on environmental management systems
- access to training and consultancy

Your first point of contact should be your local Euro Info Centre. If they cannot help you themselves, they will be happy to put you in touch with someone from the specialized group.

Note: Copies of the Environmental Technology best Practice programme case studies can be obtained from:

Environmental Helpline
NETCHEN
Building E6
AEA Technology Ltd
Abingdon
OX14 3DB
England

3. Environmental Policy

3.1. What is an environmental policy?

An ***environmental policy*** is a document prepared by your company which clearly sets out its overall aims and intentions with respect to the environment.

An environmental policy provides a sense of direction for your company and shows that it is committed to managing its environmental affairs in a responsible way. Your policy should be endorsed by your company's senior management and should be publicly available. It should be an integral part of your business strategy and be compatible with your company's other policies (e.g. on quality and on health and safety).

3.2. Why produce one?

There are a number of reasons for producing an environmental policy:

Producing a policy is an important first step towards achieving effective environmental management
Setting out your aims and intentions with respect to the environment is an important first step towards achieving effective environmental management. Having done this, your company can then take the measures necessary to achieve them. By taking appropriate measures - i.e. by carrying out effective environmental management - your company can gain the benefits that such management brings. Take the example of Wolstenholme Ltd (see Case Study 4.1), an SME whose first step down the environmental management road was to produce an environmental policy. The company then went on to develop an environmental management system which led to annual cost savings of over £100,000.

It provides important information to your external stakeholders on your aims and intentions with respect to the environment
Having an environmental policy can enhance your company's reputation with your external stakeholders such as your customers and the local community. It shows that you have made a start on dealing with your environmental performance. However, to make sure your reputation isn't tarnished in any way, it is important that your stakeholders see evidence that you are taking action to realize the aims and intentions set out in your policy.

You may have to!
Large organization are becoming increasingly concerned to ensure that the environmental management of their suppliers is of an acceptable standard. It is therefore becoming increasingly common for such organizations to require that their suppliers have an environmental policy (see Case Studies 3.1 and 3.2).

As an SME, you may not have the luxury of sitting back and deciding whether or not you wish to produce an environmental policy. If a major customer requires you to produce a policy, you will need to do so or risk losing business (see Case Study 2.10). Rather than waiting until you're asked, it makes sense to prepare a policy in your own time. That way you are prepared for any customer that requires you to have one.

Case Study 3.1 Volvo's Supply Chain Requirements.

Volvo's environmental policy states:

"*Volvo pledges to minimise the environmental impact of its operations by seeking to ensure that a similar degree of environmental concern is exercised by its working partners.*"

Under the heading "*Cooperation with suppliers*" Volvo clarifies what this will mean:

"Since many of the materials, parts and components used in Volvo products are developed and manufactured outside the Group, it is important that our environmental philosophy should extend to the operations of our working partners.

Volvo suppliers and contractors must be familiar with the Group's environmental policy, and must be prepared to submit a report on their own environmental programmes, including information on the organisation, relevant statutory requirements, goals, action plans and results. Large and strategically important suppliers must either fulfil, or submit a timetable for fulfilment of the requirements of ISO 14001 or EMAS (see Chapter 4).

Suppliers must also monitor environmental developments in their respective industries, conduct an open dialogue with Volvo and report information which may be required, for example, as a basis for life-cycle assessment. Packaging and chemicals used by suppliers must comply with Volvo's environmental requirements. The environmental impact of packaging, waste and surplus materials must be minimised, while the feasibility of recovering and recycling materials must be considered in all cases before specifying designs and materials."

In support of this policy, Volvo recently decided to call over 850 of its suppliers to Sweden to encourage them to adopt a certified environmental management system.

Case Study 3.2 British Telecom's Generic Standard (BT)

As one of the UK's major companies, BT recognises that its day-to-day activities inevitably impact upon the environment. A major element of BT's environmental impact is through its suppliers. In an attempt to assess and reduce this impact, BT requires suppliers tendering for contracts to complete a Generic Standard (GS 13) to evaluate their environmental performance. Under GS 13 suppliers must show they are committed to continuous improvement and supply information on amongst other issues "Environmental Management Policy"

"The supplier shall have a formal environmental management policy as part of its documented management system. This shall include a statement, signed at Company Director level, setting out its environmental objectives and commitments, organisation and those responsible for its implementation. This statement shall be available to the public"

3.3. How does my company produce one?

This section is divided into 5 parts:

I. Before you start
II. Sources of information when preparing your policy
III. Guidelines on format, style and content
IV. Disseminating your policy
V. Implementing your policy

I Before you start

Before you begin to develop a policy it is important to get the backing of the company's senior management. This will help to ensure that the policy is effectively implemented once it has been written. One way of making management's commitment visible is to have your policy signed by, for instance, the company chairman/women and/or the managing director.

II Sources of information when developing a policy

There are a number of sources of useful information that you can use when developing your policy.

Source	Comments
Other companies' environmental policies	Looking at policies developed by other companies will give you ideas on content, format, style, wording etc. Policies developed by companies in your own industrial sector will be of particular interest.
Your employees	Your employees are a good source of ideas and information. Including them in the policy development process will mean they have a greater sense of ownership of the policy.
Other relevant stakeholders	You may want to consider any opinions that your customers and members of the local community have about the contents of your policy.
Environmental management system (EMS) schemes	Both ISO 14001 and EMAS, (the environmental management system schemes dealt with in Chapter 4), require a company to produce an environmental policy, and lay down various requirements about what the policy must contain. In addition ISO 14004 provides general guidance on writing an environmental policy for an EMS. You may find this information useful, particularly if you may wish to establish an EMS at a later date.
Environmental charters	The various charters set out in Chapter 11 can

	provide ideas for the content of your policy.

III Guidelines on format, style and content

When writing an environmental policy the following points should be considered:

- **Keep it short**
  A policy sets out your aims and intentions regarding the environment - it is not intended to be a detailed action plan. So ideally an environmental policy statement should be brief - no more than one or two pages. This means it can be easily disseminated and increases the likelihood of it being read!

- **Mind your language**
  Your policy will be read by a wide variety of people so it is important that it is written in such a way that it can be easily understood. Technical and specialized language should be avoided.

  As you will be using a limited number of words to communicate important issues, the words you use should be chosen with care. Consider, for example, the following phrases relating to reduction of environmental impact. Although they deal with they same issue, they all communicate slightly different meanings:

  - Our company will aim to reduce...
  - Our company will endeavour to reduce...
  - Our organization will strive to reduce...
  - Our organization is committed to reducing...
  - Our organization will reduce...

  It is important that your company neither commits itself to goals that are unrealistic or conversely, makes statements that are weak and non-committal.

- **Specific objectives and targets should be published separately**
  An environmental policy is a broad statement of aims and intentions. In order to achieve these, your company may wish to set itself detailed objectives and targets. However these are generally not included in the policy document itself. For a start your company may not have done the necessary investigation into its environmental activities to be in a position to formulate objectives and targets. And even if it has, the fact that there may be a large number of such objectives and targets and these will change from year to year, would mean that including them in the policy document would make it unnecessarily long and complicated. It is best to separate your statement of aims and intentions from the specific measures you intend to implement in order to realize them.

- **Make sure that your policy is relevant to your company**
  Whilst you should avoid making your policy too specific, you should also avoid making it too general. A common problem with many environmental policies is that they are written in such a general manner that they could apply to almost any company. It is important to make your environmental policy relevant to the activities that your company carries out in order to show those who read it that you are aware of the particular

environmental issues that your company needs to address. The phrases set out below may help you to draft a policy appropriate to your business.

Our business will...

- seek to improve its environmental performance continuously.
- foster the commitment of all management and staff to improving the environmental performance of the business.
- adopt a total "cradle-to-grave" assessment and responsibility of our products and services (see Chapter 8).
- aim to minimize the use of all materials, supplies and energy. Wherever possible we will use renewable or recyclable materials and component.
- minimize pollution produced in all parts of the business, and aim for "pollution-free" processes.
- adopt an environmentally sound transport strategy.
- assess the environmental impact of all our operations past, present and future.
- expect similar environmental standards to our own from all third parties involved with our business - suppliers, vendors, contractors.
- assist our customers to use our products and services in an environmentally sensitive way.
- liaise on a continuous basis with the local community.
- include environmental consideration in investment decisions.
- assist in developing economically-viable solutions to environmental problems in our industry.

IV Disseminating your policy

Having developed your environmental policy, it is important to ensure that your key stakeholders receive copies. These stakeholders may include customers, suppliers, shareholders, regulators and key persons and organizations in the local community. And be ready to post out your policy to those people that hear about it and approach you for a copy. You can also publish your policy in your company's annual report and, if you produce one, in your environmental report (see Chapter 10).

All staff should receive a copy of your policy and you should ensure that all staff understand the policy and their role in implementing it.

V. Implementing your policy

It would be wrong to view the production of an environmental policy as an end in itself. A policy has to be implemented i.e. action has to be taken to achieve its aims and intentions. If your company's policy is to become a practical reality, your company will need to:

- be familiar with those elements of its activities, products and services which affect the environment

- set itself specific objectives and targets relating to these elements - especially those that have or could have a significant impact on the environment. The aim here is to find ways of improving its environmental performance that also improve its business performance.
- take action to meet these objectives and targets
- measure its environmental performance to check its objectives and targets have been met.

To do this, it will be necessary for your company to manage its environmental affairs in a systematic way. The following chapters describe various environmental management tools that will allow you to do this and so gain the benefits that such management can bring.

Case Study 3.3 The environmental policy of Moorhouse & Brook

Moorhouse and Brook, an SME based in West Yorkshire, UK, is a busy mill, world-famous for its natural fibres. Its policy reads as follows:

The Company recognises environmental issues are of fundamental importance to a successful business strategy. We are therefore:-

- *Committed to conducting our business in consideration of ecological needs, minimising the environmental impact and ensuring sustainable economic growth whenever and wherever possible.*

- *Dedicated to improving the awareness of the environmental performance of the Company and its products in a way that reflects the concerns of employees, customers, shareholders, insurers, regulators, suppliers and the local community.*

It is our policy to:-

- *Maintain EMAS registration.*

- *Ensure the activities of Moorhouse & Brook comply with all statutory requirements of environmental legislation and aim at the continual improvement in environmental performance over defined time scales.*

- *Establish a management system which includes the organisational structure, responsibilities, practice, procedures and resources for determining and implementing the environmental policy.*

- *Provide information and appropriate training of its workforce in the relevant aspects of environmental best practices. This will be an on-going exercise in accordance with ever increasing internal standards and external requirements.*

- *Preferably, purchase and use raw materials, energy, water, technology and equipment in a way that helps to preserve natural resources.*

- *Design products and processes which keep emissions to the environment and the formation of wastes at a minimum and constantly review them for opportunities to reduce energy and water consumption, emissions and wastes.*

- *Work with suppliers, customers, contractors and subcontractors to positively influence them in terms of our environmental policy.*

- *Deal with all environmental issues either at, or, as close to their source as it is practicable, ensuring contingency plans and procedures are in place in case of a major incident.*

- *Determine, collect, validate, update and document the data and information relevant to assessment and / or monitoring of the possible impact of substances and processes on the environment.*

- *Aim for continual improvement of the company's environmental performance by setting, publicising and reviewing environmental objectives and targets.*

Further Information

Environmental Management Systems: Principles and Practice (Hunt and Johnson, McGraw Hill, 1995) pp 123-132.

4. Environmental Management Systems

4.1. What is an environmental management system?

A system can be thought of as

> *a number of interrelated elements functioning together to achieve a clearly defined objective.*

We can therefore say that

an ***environmental management system (EMS)*** consists of a number of interrelated elements that function together to achieve the objective of effective environmental management.

So what are the elements that make up an environmental management system? Many larger companies have had environmental management systems in place for a number of years. As each company has designed its system to meet its particular needs, these systems have differed widely i.e. they contain a differing combination of elements. Recently, however, a common model for an environmental management system has been formulated by the International Organization for Standardization (ISO) which standardizes the elements that an environmental management system should contain. The model has been designed to be applicable worldwide and to organizations of all types and sizes and is set out in the standard

- ***ISO 14001 Environmental Management Systems - Specification with Guidance for Use***

The environmental management system model set out in ISO 14001 is described below. The section then goes on to look at a second environmental management system scheme

- ***EMAS - the EC Eco-management and audit scheme***

4.1.1. ISO 14001

The elements of ISO 14001 are organized around 5 steps (see Figure 4.1), each of which is briefly described below.

Step 1 - Environmental policy

A firm drafts a policy setting out its intentions in relation to the environment. The policy must contain commitments to

- continual improvement
- prevention of pollution
- complying with relevant environmental legislation and other relevant requirements.

ISO 14001 defines "*continual improvement*" as

the process of enhancing the environmental management system in order to achieve improvements in environmental performance in line with the organization's environmental policy

Step 2 - Planning

The firm must then set itself objectives and targets relating to its 3 policy commitments and devise a plan to meet these objectives and targets.

Step 3 - Implementation and operation

Having devised its plan, the firm must then put in place the various elements necessary for its successful implementation and operation.

Step 4- Checking and corrective action

Having implemented its plan, the firm must then check to see it has been successful in meeting its objectives and targets. If any have not been met, then corrective action must be taken. The entire management system must be periodically audited to see that it meets the requirements of the standard.

Step 5 - Management review

Management must periodically review the system to ensure its continuing effectiveness and suitability. Changes are made to the system as and when necessary.

As Figure 4.1 illustrates, ISO 14001 aims to bring about continual improvement over time.

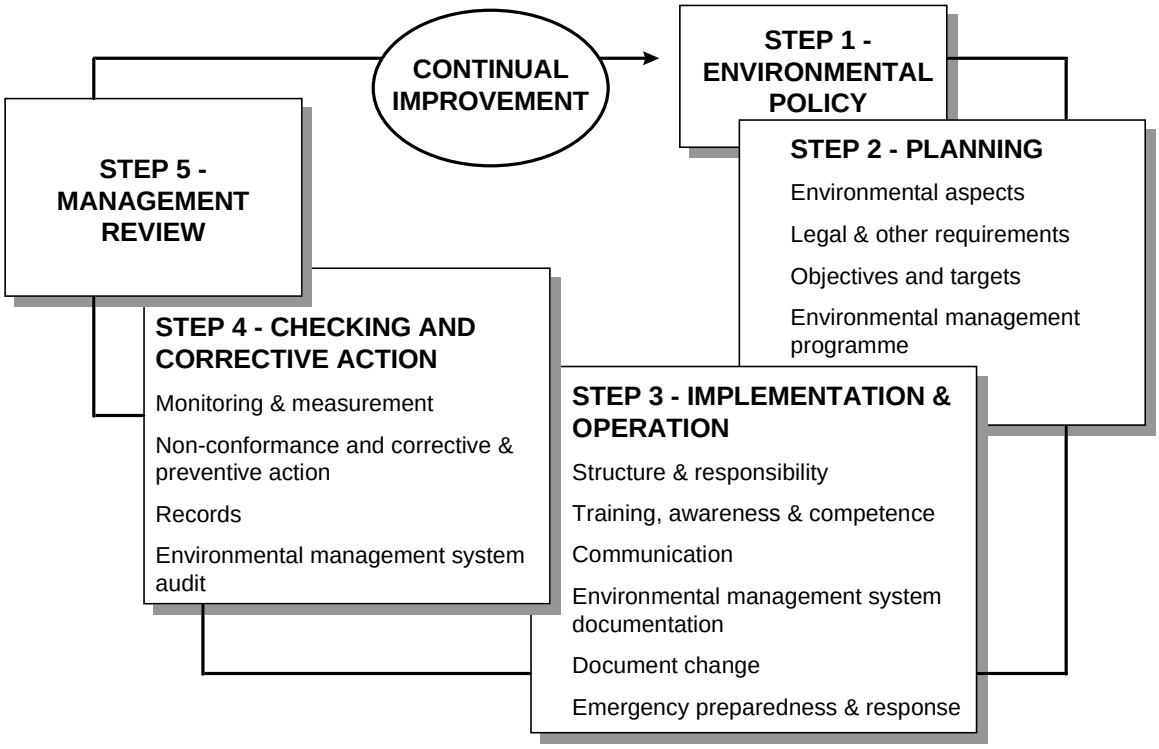

Figure 4.1 The 5 steps of ISO 14001

The elements of ISO 14001

The various elements of ISO 14001 within each of the 5 steps are described below.

Step 1 - Environmental policy

As mentioned above, a firm's environmental policy must contain commitments to continual improvement, prevention of pollution and to complying with relevant environmental legislation. In addition the policy must provide a framework for setting objectives and targets, must be communicated to all employees and must be publicly available.

Step 2 - Planning

2.1 Environmental aspects

The first thing the firm must do is to identify what the standard calls its *environmental aspects*. These are defined as

> *elements of an organization's activities, products or services which can interact with the environment.*

Once its environmental aspects have been identified, the firm must establish which of them are *significant* i.e. which of them have a significant impact on the environment. To identify its significant environmental aspects, the firm needs to undertake an *environmental review* (see Box 4.1 for details). *It should be emphasized that the environmental review is the foundation upon which the rest of the management system is built and should be conducted as thoroughly as possible.* Brief guidance on evaluating significance is given in Box 4.2.

Box 4.1: Environmental review

An environmental review should cover 4 key areas

1. legislative requirements
2. an identification of significant environmental aspects
3. an examination of all existing environmental management practices and procedures
4. an evaluation of feedback from the investigation of previous incidents

Some common techniques for conducting a review include

- checklists
- interviews
- direct inspection and measurement
- review of existing records
- review of previous audits

Areas that should be considered when seeking to identify the significant environmental aspects of the firm's activities are

- emissions to air
- releases to water
- waste management
- contamination of land
- impact of communities
- use of raw materials and natural resources

The above is the briefest of description of an environmental review. As emphasized above *the environmental review is the foundation upon which the rest of the environmental management system is built*. For instance, once the firm has firmly established what its legal requirements are, it is in a position to check if its is complying with these requirements. And once a firm has identified its significant aspects and has examined its environmental management practices and procedures it can begin to identify areas for cost-effective improvement in environmental performance and set its objectives and targets (see 2.3 below). For further information on conducting an environmental review see recommendations for further informaton at the end of this chapter.

N.B. The ecobalance tool can be used to generate the information a firm needs to identify its significant aspects - see Chapter 7

Box 4.2: Environmental aspects - significant or not?

Although ISO 14001 requires firms to identify their significant aspects it gives no guidance on how to do so. It is up to an individual firm to find a method for doing so. Judgements about whether aspects are or are not significant will always to some extent be subjective but should be made as consistent as possible by establishing and documenting a methodology for evaluation. Below are two approaches that can be used.

1. Environmental aspects are assessed for significance against a scale such as the one below[i].

Scale	***Description***	***Criteria***
1	Negligible	Very small environmental impact Low probability of occurrence.
2	Minor	Abnormal conditions would cause breach of legislation. Impact and probability of occurrence both small.
3	Significant	The activity has an impact under normal operating conditions and results in a breach of legislation under abnormal operating conditions Effect and probability of occurrence are moderate.
4	Major	The activity under abnormal conditions is a breach of legislation. Impact is extensive

2. Each aspect is assessed using the following risk assessment technique[ii].

For each aspect assign a rank order (from 1-5) in respect of:
frequency of occurrence (*F*), likelihood of control loss (*L*) and severity of consequences (*S*).
⇓
Multiply these to obtain an overall criticality factor (*C*)
$C = F \times L \times S$
⇓
Rank aspects by their *C* values and judge significance accordingly.

Ranking criteria such as those below can be used in the above calculations

Frequency of occurrence (*F*)
1 = very rare e.g. infrequent production run, to
5 = continuous e.g. a treated effluent discharge

[i] Hillary, R (199X) *The Eco-Management and Audit Scheme: a Practical Guide*, Stanley Thornes
[ii] Hunt, D and Johnson, C (1995) *Environmental Management Systems: Principles and Practice*, McGraw-Hill

Likelihood of control loss (*L*)
1 = extremely unlikely e.g. complete failure of a robust process control element, to
5 = highly likely e.g. a small spillage of widely used solvent

Severity of consequences (*S*)
1 = very limited, localized impact e.g. local dust problem
5 = extensive and severe damage e.g. toxic spillage to a large watercourse

see Table 4.1 for a survey of significant aspects in various industries

Table 4.1 The significance of impacts commonly occurring in various industrial sectors[iii]

High priority impact	

Medium priority impact	

	Solid waste	Energy	Trans-port	Water use	Wildlife / visual impact	Pur-chases	Resource use	Water pollution	Air pollution	Noise
Agriculture, forestry and fishing										
Energy and water supply										
Minerals, metals, chemicals, plastics										
Metal goods, engineering, vehicles										
Food, drink and tobacco										
Pulp and paper, other manufacturing										
Construction										

[iii] Adapted from Business in the Environment (1991) *Your Business and the Environment* by Jason Palmer, Eclipse Consultants, UK

Distribution and transport										
Communications, printing, publishing										
Banking, finance and insurance										
Retailing										
Marketing and advertising										

2.2 Legal and other requirements

Given that the firm has made a commitment in its policy to comply with legal and other requirements, the firm must establish what these actually are. This is done during the environmental review (see Box 4.1). The firm should consider how it can keep track of changes in legal requirements so it can remain in compliance.

2.3 Objectives and targets

In order to meet its commitment to legal compliance a firm must set itself the objective of identifying and correcting any non-compliance. In order to meet its policy commitment to continual improvement and prevention of pollution, the firm must set objectives and targets in relation to its significant environmental aspects.

Box 4.3: What's the difference between an objective and a target?

An environmental objective is defined as an:

overall environmental goal, arising from the environmental policy, that an organization sets itself to achieve, and which is quantified wherever possible.

An environmental target is a

detailed performance requirement, quantified where practicable...that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives

According to ISO 14004 objectives can include commitment to:

- reduce waste and the depletion of resources
- reduce or eliminate the release of pollutants into the environment
- design products to minimize their environmental impact in production, use and disposal
- control the environmental impact of raw material sourcing
- minimize any significant adverse environmental impact of new developments
- promote environmental awareness among employees and the community

Progress towards an objective can generally be measured using environmental indicators such as:

- quantity of raw material or energy used;

- quantity of emissions such as CO_2;
- waste produced per quantity of finished product;
- efficiency of material and energy use;
- number of environmental incidents/accidents;
- % waste recycled;
- % recycled material used in packaging;
- number of vehicle kilometres per unit of production;
- specific pollutant quantities e.g. NO_x, SO_2 CO, HC, Pb, CFCs;
- investment in environmental protection;
- number of prosecutions;
- land set aside for wildlife habitat.

Example

Objective: reduce energy required in manufacturing process
Target: Achieve 10% reduction compared with previous year
Indicator: quantity of fuels and electricity per unit of production

For a more in-depth treatment of environmental indicators see Chapter 5.

2.4 Environmental management programme

Having set its objectives and targets the firm must now devise a programme for achieving them. The programme must state the time-frame in which the objectives and targets are to be achieved and identify the people responsible for achieving them.

Step 3 Implementation and operation

The following elements are necessary to successfully implement and operate the environmental management programme (2.4).

3.1 Structure and responsibility

The role, responsibility and authority of everyone involved with the EMS must be defined. Management must provide the resources necessary for the implementation of the EMS. (Resources include human resources, technology and financial resources.) The firm's management must appoint someone who is ultimately responsible for ensuring that the EMS is established, implemented and maintained in accordance with the requirements of ISO 14001.

3.2 Training, awareness and competence

All staff whose work may create a significant impact on the environment must receive the appropriate training. The firm must make them aware of:

- the importance of conformance with the requirements of the EMS
- the significant environmental impacts of their work activities and the environmental benefits of improved personal performance
- their roles and responsibilities in the successful functioning of the EMS

Staff performing tasks which can cause significant environmental impacts must be deemed competent to do so. (Competence is assessed on the basis on their education, training and/or experience.)

3.3 Communication

The firm must establish and maintain suitable procedures for communication between various parts of the firm regarding the EMS. It must also make provisions for receiving and responding to relevant communications about its EMS from external parties.

3.4 Environmental management system documentation

The firm must establish and maintain information - in paper or electronic form - to

- describe the elements of the management system and their interaction
- provide direction to related documentation

3.5 Document control

The firm must establish procedures for controlling all the documents required by ISO 14001 to ensure, for instance, that they can be located and that they are periodically reviewed, revised as necessary and approved by authorized personnel.

3.6 Operational control

The firm is required to identify those of its activities that are associated with the significant environmental aspects covered in its objectives and targets. The firm then needs to produce documented operating procedures for these activities to cover situations where, if no procedures existed, the objectives and targets might not be met.

The firm must also establish procedures relating to the significant aspects of goods and services used by the organization. All relevant procedures must be communicated to suppliers and contractors.

3.7 Emergency preparedness and response

The firm must establish and maintain procedures to

- to identify potential accident and emergency situations
- to respond to these situations should they arise and
- for preventing and mitigating the environmental impacts that may be associated with them

The firm must periodically test these procedures where practicable and review and revise them where necessary - particularly after the occurrence of accidents or emergency situations.

Step 4 Checking and corrective action

4.1 Monitoring and measurement

The firm must establish and maintain documented procedures to monitor and measure on a regular basis, those areas covered by the objectives and targets in order to see if the objectives and targets have been met. The firm must also establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations.

4.2 Non-conformance and corrective and preventive action

The firm must establish and maintain procedures for defining responsibility and authority for

- investigating and handling instances of non-conformance with the targets and objectives it has set for itself
- taking action to mitigate any impacts caused and
- for initiating and completing corrective and preventive action.

The organization must record any changes it makes to its procedures as a result of any corrective and preventive action that it undertakes.

4.3 Records

The organization must establish and maintain procedures for the identification, maintenance and disposal of its environmental records. These records must include training records, the results of audits (see 4.4) and management reviews (see 4.5).

4.4 Environmental management system audit

The firm is required to establish and maintain a programme and procedures for periodic environmental management system audits to be carried out. The audit seeks to determine whether or not the EMS

- conforms with the requirements of the ISO 14001
- has been properly implemented and maintained

The audit programme and procedures should cover

- the activities and areas to be considered in audits
- the frequency of audits
- the responsibilities associated with managing and conducting audits
- the communication of audit results
- auditor competence
- how audits will be conducted

Note: The subject of EMS auditing is covered in detail in Chapter 5

Step 5 - Management review

The firm's management must periodically review the environmental management system to ensure its continues to meet the needs of the firm. The review must address the possible need for changes to the firm's policy, objectives and other elements of the environmental management system in light of

- the audit results
- changing circumstances
- the firm's commitment to continual improvement.

The commitment to continual improvement and prevention of pollution will mean that new objectives and targets will have to be set and changing circumstances, for instance the introduction of new products and processes, will mean that new procedures need to be written and new roles and responsibilities designated.

Further information relating to ISO 14001

No absolute requirements for environmental performance

It should be noted that ISO 14001 does not establish absolute requirements for environmental performance beyond commitment in the policy to compliance with

applicable legislation and regulations and to continual improvement. Hence, two firms carrying out similar activities but having *different environmental performance* may both comply with the requirements of the standard.

Relationship to ISO 9000

ISO 14001 shares common management system features with the ISO 9000 series of quality system standards and firms can use their ISO 9000 management system as the basis for their environmental management system. The linkages with ISO 9000 are set out in ISO 14001.

ISO 14001 becomes a European Standard

The European Committee for Standardization (CEN) adopted ISO 14001 as a European standard at the end of September 1996. When a European standard is adopted, all national standards within Europe on the same subject must be withdrawn within 6 months of the adoption. Therefore all of the national environmental management system standards in Europe i.e.

- the British standard BS 7750
- the Irish standard I.S. 310
- the French standard X30-200
- the Spanish standard UNE 77-801(2)

were withdrawn by the end of March 1997.

Obtaining copies of ISO 14001

To obtain a copy of ISO 14001 (and of ISO 14004) contact your national standards body - see Appendix 4.1

ISO 14001 - self-declaration and certification

ISO 14001 is a specification standard i.e. it consists of a *set of requirements* for establishing and maintaining an environmental management system. By complying with these requirements a firm can demonstrate to the outside world that it has an appropriate management system in place. One way in which a firm can demonstrate that it has met the requirements of the standard is by "*self-declaration*" which means that the firm checks its own compliance with the requirements. However a firm may feel it carries more weight with the outside world if its compliance with the requirements of ISO 14001 is checked by an independent third party. This third party checking is known as "*certification*".

If a firm decides that it wants to become certified to ISO 14001, how can it be sure it is employing the services of a competent certifier? In order to be sure, the firm should employ the services of an *accredited* certifier. Each member state within the EU has an *accreditation body* that can accredit certifiers. Accreditation is the procedure by which an accreditation body gives formal recognition that a certifier is competent to carry out certification activities. (To be deemed competent, a certifier has to comply with specific criteria laid down by the accreditation body.) The accreditation system for environmental management systems is set out in Figure 4.2. For a list of accredited certifiers contact your national accreditation body (see Annex 4.2).

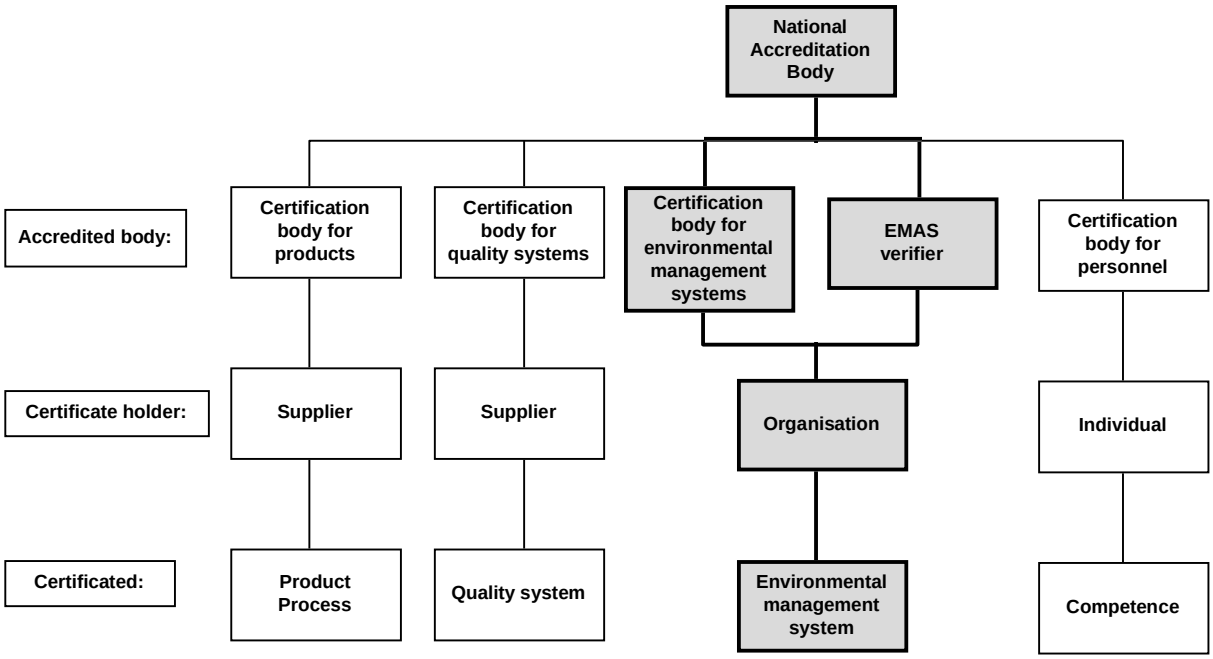

Figure 4.2 The accreditation system for environmental management systems[iv]

ISO 14004

In addition to ISO 14001, ISO has published a second standard on environmental management systems

ISO 14004 Environmental management systems - General guidelines on principles, systems and supporting techniques

As its title suggests, ISO 14004 consists of general guidance on a broad range of management systems issues. The standard:

- is based around a very similar 5 steps model to that of ISO 14001
- contains guidance on all the elements of the ISO 14001 management system, as well as on additional relevant EMS topics. (The guidance in ISO 14004 includes self-assessment questions for each element together with a series of "practical help" sections based on industry experience of environmental management.)

ISO 14004 provides useful guidance for a firm wishing to establish an EMS that conforms with the requirements of ISO 14001. It will also be useful for firms who are interested in establishing an EMS but are not yet ready to, or do not wish to establish an ISO 14001 system (see Section 4.3. for further details).

Box 4.4: Are ISO 14001 and 14004 relevant to SMEs?

[iv] Reproduced with the permission of European Accreditation of certification (EAC).

The answer to this question is "yes". ISO 14001 states that "*it has been written to be applicable to all types and sizes of organizations and to accommodate diverse geographical, cultural and social conditions*".

ISO 14001 also states that "*the level of detail and complexity of the environmental management system...and the resources devoted to it will be dependent on the size of an organization and the nature of its activities. This may be the case in particular for SMEs*". In other words an environmental management system should be tailored to the needs of the particular firm establishing the system. Environmental management systems should not be complex and unwieldy but should be designed so that they are simple and user-friendly.

ISO 14004 states that "*it can be used by organizations of any size. Nonetheless, the importance of SMEs is being increasingly recognized by governments and business. This guideline acknowledges and accommodates the needs of SMEs*".

4.1.2. EMAS - The EC eco-management and audit scheme

ISO 14001 is not the only environmental management system scheme existing in Europe. A second scheme, the EC eco-management and audit scheme (EMAS), has been operating since 1993.

Differences between ISO 14001 and EMAS

- Whereas ISO 14001 is applicable worldwide, only EU member states can participate in EMAS.
- Unlike ISO 14001, EMAS is not a standard but a Regulation (A Regulation is a type of EU legislation).
- Whereas a whole company, a specific site or a specific activity can be certified to ISO, only individual sites can be registered under EMAS.
- Whereas ISO 14001 is applicable to all organizations, only companies performing industrial activities specified in the EMAS Regulation can participate in EMAS.
- Whereas ISO 14001 only contains requirements for an environmental management system, the EMAS Regulation

  1. contains requirement for an environmental management system
  2. requires a firm to produce an environmental statement and
  3. requires that a firm's EMS and statement beindependently verified.

These 3 requirements are discussed below.

The three requirements of EMAS

1. Environmental management system

The requirements of EMAS regarding an environmental management system are very similar to those of ISO 14001 and so will not be discussed further here. For information on the difference between the requirements see Box 4.5

2. Environmental statement

EMAS requires that a firm produces an environmental statement that describes the firm's environmental management system and its environmental performance.The statement must be publicly available and must include the following:

- a description of the company's activities at the relevant site
- an assessment of all the significant environmental issues of relevance to the activities concerned
- a summary of the figures on pollutant emissions, waste generation, consumption of raw materials, energy and water, noise and other significant environmental aspects as appropriate
- other factors regarding environmental performance
- a presentation of the company's environmental policy, programme and management system implemented at the site
- the deadline set for the submission of the next statement
- the name of the accredited environmental verifier

3. Verification

Not just anyone can verify that a firm's environmental management system and environmental statement meet the Regulation's requirements. The verification must be done by an independent accredited environmental verifier. EMAS requires each member state of the EU to "*establish a system for the accreditation of independent verifiers and for the supervision of their activities*". In most EU countries it is the same accreditation organization that accredits both ISO 14001 certifiers and EMAS verifiers.

Box 4.5 The relationship between EMAS and ISO 14001

If a firm has an ISO 14001 environmental management system and wants to become registered under EMAS, what must it do?

In order to make its environmental management system meet the requirements of EMAS it must modify its management system slightly. The changes that need to be made are set out in a guidance document prepared by CEN (to otbtain a copy contact your national standards body). The firm must also meet the EMAS requirements regarding the environmental statement and verification described above.

If a firm is registered under EMAS and want to become certified to ISO 14001 what must it do?

Meeting the requirements of EMAS means that it is almost certain that all the requirements of ISO 14001 have been met. The ISO 14001 certifier will have to check that this is the case - which will in all probability just be a paper exercise - and certify your company to ISO 14001.

Each EU member state has appointed an organization - known as a "*competent body*" - to administer EMAS. To obtain a copy of the EMAS Regulation and further information regarding the scheme contact your national competent body - see Appendix 4.3

Case Study 4.1 Wolstenholme International Ltd[v]

Wolstenholme International Ltd employs 260 people at its site in Darwen, Lancashire, UK. The company produces bronze and copper powders in a foundry and milling operation, and aluminium powder from granulated aluminium foil. The powders are used as a pigment in printing inks, paints, plastics and in lightweight concrete and various other industrial applications.

In August 1992 Wolstenholme took the decision to pursue certification to the then British Standard for environmental management systems, BS 7750 and it achieved certification in March 1995.

[v] Case Study GC49, Environmental Technology Practice Programme, UK

As a result of the EMS process, 21 environmental improvement initiatives were implemented. Table 1 shows the costs and savings of these initiatives and Table 2 shows the administration and human resource cost of implementing the EMS at Wolstenholme. Table 3 shows that whilst the total implementation cost of the EMS was £36,500, the annual savings arising from the system are a massive £96,100. The payback time was therefore extremely short - only 4.4 months.

Table 1 Environmental initiatives: costs and savings (1995)

Item	Equipment cost (£)	One-off savings (£)	Annual savings (£)
Waste reduction	5 800		39 800
Raw materials and consumables	8 000	25 000	2 000
Energy efficiency	24 000	6 000	31 800
Liquid effluent management	4 100		
Avoided equipment costs		4 000	
Total	**41 900**	**35 000**	**103 600**

Table 2 Administration and human resource costs of EMS implementation

Item	Cost (£)
Internal staff costs	19 750
External training courses	870
Consultancy	3 600
BS 7750 certification costs	5 180
Total	**29 400**

Table 3 Net cost, net saving and payback

Net EMS implementation cost	**(£)**
Equipment costs (see Table 1)	41 900
plus Staff and administration costs (see Table 2)	29 400
minus One off savings (see Table 1)	35 000
Total	**36 000**
Net annual savings	
Annual savings	103 600
minus Annual labour costs (waste reduction)	2 000
minus Annual EMS maintenance costs	5 500
Total	**96 100**

The good housekeeping measures put in place at Wolstenholme have not only led to reductions in raw material use, energy use and waste (an associated cost savings) but also to reduced environmental emissions. For instance 60% less copper is discharged in effluents and the foundry's VOC emissions have decreased by over 75%. Increased environmental awareness amongst the staff led to some employees forming a voluntary "Green Group" to carry out local conservation activities and this has enhanced relations with the local community. In addition the EMS has meant that the company's profile with its customers, environmental regulators and insurers has been raised. In July 1996 Wolstenholme became registered under EMAS.

The Chief Executive of Wolstenholme, Mr P Rink says:

"*Implementing our environmental management system and obtaining certification to BS 7750 was an integral part of our drive for continuous improvement. As well as cost savings*

and reduced environmental emissions, we have peace of mind from knowing that we can demonstrate compliance with all relevant environmental regulations. As part of our aim to work with the local community, we take pride in publishing details of our environmental activities and the achievement of our environmental improvement objectives. In July 1996 we achieved registration under the EMAS Regulation and this enables the Company to produce Environmental Statements that have the credibility of being externally verified. EMAS will be used to promote the company in Europe."

4.2. Why implement an environmental management system?

Whilst there are obviously costs involved in setting up and operating an environmental management system, the system can also bring great benefits. A firm should establish an environmental management system if it believes that the benefits from doing so will outweigh the costs involved.

Costs

The costs involved can include:

- staff time spent establishing and maintaining the system
- payment of consultants, if used to help establish the system
- payment of ISO 14001 certifier/EMAS verifier

Benefits

Some of the benefits that arise from establishing an EMS are set out below:

- ***A cost effective approach***
  An EMS takes a systematic approach to environmental management and a systematic approach is a *cost-effective* approach. The environmental review highlights *all* the areas of the firm where improvement in performance is possible. With this information, a firm can assess which improvements will produce the greatest benefits in terms of cost savings and reduction of risk, and deal with these areas first. *The firm can then set targets that benefit both itself and the environment*.

- ***Targets not just set but met***
  An EMS not only requires firms to set themselves targets but ensures that they meet them. A firm must devise a management programme for achieving its targets, ensure that the resources are available for it to be carried out, monitor its environmental performance to check it has met it has met its targets and take corrective action if it finds it has not.

- ***Legislative compliance ensured***
  As well as bringing about a continual improvement in environmental performance, an EMS enables a firm to ensure it is complying with relevant legislation and regulations. The environmental review identifies all the legislation and regulations with which the firm should be complying and the firm must then establish procedures for checking compliance and for taking corrective action should it discover instances of non-compliance.

- ***Improved public image and increased market opportunities***
  Not only do ISO 14001 and EMAS enable a firm to meet its environmental policy commitments and its objectives and targets, they also enable the firm to demonstrate sound environmental management to stakeholders. There may be considerable public relations benefits and increased market opportunities for a firm that can demonstrate to the outside world that it has a sound system of environmental management.

- ***Viewed more favourably by the regulator and the financial sector***
  Having a management system can mean less supervision from environmental regulators (see Case Studies 2.12 and 4.3) and preferential treatment from banks and insurers. And the fact that an EMS demonstrates sound environmental management may well improve your ability to attract investment.

Case study 4.2 Woodcote Industries Limited[vi]

Woodcote Industries Limited, a drop forging and engineering company, employs 230 people and is located in the West Midlands, UK. Woodcote was formed in 1992 and has two divisions, the Forging Division and the Products Division. The Forging Division supplies high quality steel forgings to Woodcote's own Products Division and also to the tractor manufacture, automotive, mining, railtrack and commercial vehicle air brake systems industries. The Products Division boasts the world's most comprehensive range of scaffolding fittings and, in addition to supplying the domestic market, makes significant exports to the USA, Middle East, Australasia, South America and Asia Pacific.

Woodcote began the process of implementing BS 7750 in 1992 and it is now both certified to BS 7750 and registered under EMAS. Taking this management system approach has brought about significant benefits for the company. For instance Woodcote has been able to achieve big cost savings by substantially reducing its energy consumption. Drop forging is an energy-intensive process with considerable heat needing to be generated to serve Woodcote's 18 forging units and the firm has managed to make 50% energy savings worth a massive £250,000/year. Woodcote has also reduced the noise impact that its site has on the local community. And in addition there has been a noticeable improvement in company culture. According to the executive chairman Jim Mundell "*the major benefit has been to change the culture on site. Three or four years ago the site was at best scruffy, but EMAS and BS 7750 group registration have raised environmental awareness at all levels*".

Woodcote is determined to enter the 21st century with the best possible environmental management system in place. It has established clear objectives in four key areas of noise, energy, steel process waste and emissions to atmosphere which it has set out in the company EMAS statement.

4.3. How should my firm go about setting up an environmental management system?

As the first section of this chapter has shown, a firm has a number of options when it comes to establishing an environmental management system.

4.3.1. Environmental management system options

[vi] Case Study Two, UK Competent Body for EMAS, Department of the Environment

A firm can

1. establish a management system based on the guidelines set out in ISO 14004;
2. establish a management system that meets the requirements of ISO 14001 and self-declare;
3. become certified to ISO 14001 by an accredited third party certifier;
4. become site registered under EMAS;
5. both 3 and 4

Note: Of course, a firm may decide that due to its small size or its minimal impact on the environment, it does not require a formal management system. In this case the firm may choose to manage its environmental performance by developing a simple set of environmental indicators (see Chapter 6).

Which option should a firm choose?

By developing an EMS based on the ISO 14004 guidelines (option 1), your firm can improve its environmental performance and at the same time ensure legal compliance, reduce its environemntal risk and achieve cost savings. However, because ISO 14004 is a guidance document and not a set of requirements it is not possible to demonstrate compliance either by self-declaration or third party certification.

By following one of options 2-5, it is possible to demonstrate compliance with the requirements of ISO 14001 and/or EMAS and demonstrating compliance to the outside world can bring with it the additional benefits of

- improved public image and community relations
- improved relations with regulators
- preferential treatment from banks and insurers
- an increased ability to attract business and investment

If your company is not seeking such benefits or feels that none of them would result from pursuing options 2-5 then it should pursue option 1.

It is worth noting that a management system based on the guidance in ISO 14004 can easily be upgraded to meet the requirements of ISO 14001 or EMAS, should changing circumstances make it advantageous to do so.

As discussed earlier in the chapter, options 3-5 are likely to be seen as more credible demonstrations of sound environmental management than option 2 and thus they are likely to bring greater external benefits. On the other hand options 3-5, unlike option 2, involve the costs of certification/verification.

If you feel that there are likely to be no extra benefits from options 3-5, or if you feel the possible additional benefits do not justify the expense of certification/verification, then chose option 2.

If, however, your firm feels that the benefits of ISO 14001 certification/EMAS registration are likely to outweigh the additional costs you will chose one of options 3-5. Whereas EMAS is applicable only within the EU, ISO 14001 is applicable worldwide.

If most of your business is in Europe this may sway you in the direction of EMAS. If, on the other hand, you export widely outside Europe then ISO 14001 may be preferable.

You may of course decide that there are good business reasons why your firm wishes to become both ISO 14001 certified and EMAS registered. If so, your firm could either

- become certified to ISO 14001 and take the additional steps to gain EMAS registration at a later date. (As pointed out in Box 4.6 it is fairly straightforward to gain registration under EMAS once a certified ISO 14001 is in place.) In this case it may be sensible to use the same consultants to verify compliance with EMAS as were used to certify compliance with ISO 14001 as they will already be familiar with the firm's management system
- become certified to ISO 14001 and registered under EMAS at the same time.

Case Study 4.3 The Dutch covenant system

As early as 1989 a Dutch Government report stated that

"*companies which do not have an efficiently operating environmental management system at their disposal will, in the Government's view, be sooner considered for intensified enforcement activities by competent enforcement authorities relative to companies which have an efficiently operating environmental management system*".

This is now the case. In the Netherlands a voluntary system of covenants between government and industry has been developed. Those companies that choose to participate in the covenanting process must establish a corporate environmental plan (CEP) which establishes targets for performance improvement and develop an environmental management system (EMS) to help to achieve these targets. Regulators acknowledge that companies that participate in the covenanting process (and have established a CEP and an EMS) are generally subject to a less intensive and less prescriptive regulatory supervision than those that do not. This means that regulators visit these companies less frequently and are less prescriptive about the technologies and techniques that these companies use to reach their environmental targets. For those companies without an EMS, the regulators are much more likely to tell companies what technologies and techniques they must use to achieve their intended level of environmental performance. In the chemical sector, for instance, the requirements set out by the regulator for a company without an EMS can cover 70 pages, whereas the requirements for a similar company with a CEP and EMS can be a short as 1 or 2 pages!

Furthermore, for those companies that have a CEP and an EMS, regulators suggest that as the continued efficacy of the EMS is demonstrated over time (i.e. by delivering progress towards the targets of the CEP), further gradual reductions in the intensity of regulatory supervision will be approved. For the regulator this allows scarce resources to be channelled toward poor performers and high risk companies and for regulated companies it established a further incentive to sign up to the covenant and therefore to establish a CEP and develop an EMS.

4.3.2. Time and cost involved in installing an environmental management system

As mentioned earlier, the cost of establishing an environmental management system includes staff time and may also include consultancy fees. During 1995, consultants Coopers and Lybrand conducted a study - involving 19 firms of between 20 and 300 employees - of the resources required to obtain EMAS registration. The study found that a minimum of 40 person days (including both staff and consultancy time) were required to achieve registration and for some companies subject to extensive environmental regulation the number of person days was substantially higher. One highly regulated company with 250 employees estimated that it would take up to 240 person days to achieve registration. (**Note**: Becoming certified to ISO 14001 will require similar amounts of time to those quoted above.)

Should external help be used?

There are guides/manuals available that are designed to enable firms to establish their own environmental management system (see *Further Information*). You may want to take this approach, perhaps using external expertize to provide guidance where appropriate. Alternatively, you may feel more comfortable with using external experts to establish your system. To whatever degree you use external expertize, investigate thoroughly the options for obtaining low cost/free external help (see section 2.3). In the UK for instance, some environmental business clubs (mentioned in 2.3) offer free environmental reviews for their members.

There may also be schemes available to subsidize the cost of using consultants. In the UK the government has set up the *Small Company Environmental and Energy Management Assistance Scheme (SCEEMAS)* that provides SMEs with up to 50% of the cost of hiring consultants to guide them to EMAS registration.

Remember, if you are using external experts

- make sure that the system they set up is tailored specifically to your firm's needs and is as simple and easy to maintain as possible.
- work with them to ensure that you becomes familiar with the system and feel competent to maintain it.

Case Study 4.4 Loudwater[vii]

Loudwater is a printers, based in Watford, UK Its core business is printing greeting cards and it sells more that a million cards a year. The company became certified to BS 7750 in 1995 and became registered under EMAS in 1996 - the first small company (i.e. less than 50 employees) in the UK to do so. Loudwater started on the EMS path out of a desire to achieve targeted efficiencies and commercial success. It was also a way of dealing with supply chain pressures. As managing partner Marc Cox says "*The large retailers, and also the publishers were asking more and more questions about environmental aspects of our business and we had to be prepared and ready with answers*".

Loudwater has achieved substantial cost savings as a result of implementing its environmental management system and its improved reputation has resulted in a substantial amount of new business. In fact, Loudwater's turnover has almost doubled to nearly £5 million since achieving EMAS registration. As Marc Cox says "*We have saved in excess of £20,000 by reducing our waste, cutting down on our energy consumption and by recycling or selling our unavoidable waste. We are winning new business all the time, particularly from blue-chip companies which previously would not have considered us. The fact that we can*

[vii] Case Study One, UK Competent Body for EMAS, Department of the Environment

prove our green credentials through EMAS and demonstrate our ability to work within the framework of environmental legislation in a wider Europe gives us that competitive edge".

Further Information

Eco Management Guide This helpful guide has been prepared by a number of EU Euro Info Centres. It provides information to help you become registered under EMAS and allows you to assess whether your management system meets the EMAS requirements. To obtain a copy contact your local Euro Info Centre. Copies are available in most European languages.

in addition to contacting your national competent body for information on EMAS, you can also contact the Commission's **EMAS Help Desk**. The Help Desk website contains a large amount of relevant information.

Fax: +32 3 511 5666
e-mail: helpdesk@emas.lu
website www.emas.lu

ISO 14001 Environmental Management System Self-Assessment Checklist. This easy-to-use checklist is published by the Global Environmental Management Initiative (GEMI) and is available from:

GEMI
2000 L Street NW, Suite 710
Washington, DC 20036
USA
Tel: +1 202 296 7449
Fax: +1 202 296 7742
e-mail: GEMI@worldweb.net

A DIY environmental review for companies 2nd Edition (Business and the Environment/ Coopers and Lybrand, 1994) is an excellent guide for companies that wish to carry out their own environmental review.

Environmental effects: A guide to assessing the significance of environmental effects The Environmental Advice Centre, a subsidiary of the British Trust for Conservation Volunteers has produced this guide to assist companies assess the significance of their environmental effects (EMAS uses the term "*effects*" while ISO 14001 uses the terms "*aspects*" and "*impacts*"). The guide was designed with SMEs in mind and in its preface states that

> *This guide is intended to be used by organizations to help assess their impacts upon the environment. The guide is designed in a way that enables highly subjective views on a wide range of envir0nmental issues to be judged more accurately and consistently.*

Copies can be obtained from:

The Environmental Advice Centre
Bessemer House
59 Carlisle Street East

Sheffield
S4 7QN
England

Tel: +44 114 275 5087
Fax: +44 114 276 2148
E-mail: eac@dial.pipex.com

Environmental Management Systems: Principles and Practice (Hunt and Johnson, McGraw Hill, 1995) is a detailed and comprehensive guide to establishing and maintaining an environmental management system. A very useful reference work.

Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations
The US Environmental Protection Agency has produced this implementataion guide which is available on the WorldWide Web and can downloaded in several formats. The download site is *http://info.bus.utk.edu/strategy/envmgmt.htm*

UNEP/ICC/FIDIC Environmental Management Systems Training Resource Kit
This Kit, produced by the United Nations Environment Programme (UNEP), the International Chamber of Commerce (ICC) and the International Federation of Consulting Engineers (FIDIC), can be used by managers who wish to provide EMS training for their staff. The Kit contains

- a trainer's guide with suggestions for one- and two-day training programmes
- lecture material on the background and purpose of and EMS and on "the A-Z of EMS"
- a comprehensive collection of overhead transparencies that can be used in training courses
- 22 exercises, integrated in the lecture material. to use during training
- 8 case studies that can be used in lectures or as part of exercises

The UNEP/ICC/FIDIC Environmental Management Systems Training Resource Kit is available in the following languages from the organizations listed.

English version
Environmental Management Systems Training Resource Kit
SMI (Distribution Services) Ltd., P.O. Box 119 - Stevenage HERTFORDSHIRE SG 14TP, UK, Tel: (44.1438)748.111, Fax: (44.1438)748.844, E-mail: Enquire@SMIBooks.com

German version
ASIC, Schweizeische Verinignung Beratender Ingenieure, Geschäftsstelle, Postfach 6922, CH-3001 Bern, Schweiz, Fax: (41.31)382.2670, or

VBI, Verband Beratender Ingenieure, Deutschland Am Fronhof 10, D-53177 Bonn, Deutschland, Fax: (49.228)957.18.40

Hungarian version
Budapest University of Economic Sciences, School of Business Administration, Department of Environmental Economics, Maria Csutora, Fövám Tér 8, 1093 Budapest, Tel/Fax: (36.1)2188.076

Italian version
Manuale die Formazione al Sistema di Gestione Ambientale
ICC ITALIA, Via XX Settembre N° 5, 00187 Roma, Italia, Fax: (39.6)488.2677

Spanish version
Manual de Capacitatión sobre Sistemas de Manejo Ambiental
CAMARA DE COMERCIO DE BOGOTA, Carrera 9, N° 16-21, P.O. Box 29824, Santafé de Bogotá, Colombia, Fax: (571)284.2966

The Euro-vironment CD ROM
This CD-ROM provides a multimedia vocational training tool in environmental management. Developed with support from the EU, UNEP, ICC and FIDIC, the CD-ROM provides

- a certifiable 11 module training course based on the UNEP/ICC/FIDIC Training Kit mentioned above
- a collection of EMS implementation case studies
- access to various templates to guide you through the relevant steps of implementing an EMS
- a database of useful reference material

For further information contact

Entropy International
Suite 8, Church House
96 St. Mary's Gate
Lancaster, LA1 1TD
United Kingdom

Tel: +44 (0)1524 389385
Fax: +44 (0)1524 389386
e-mail: entropy@ndirect.co.uk
http://www.ndirect.co.uk/~entropy/

Note: Copies of the Environmental Technology best Practice programme case studies can be obtained from:

Environmental Helpline
NETCHEN
Building E6
AEA Technology Ltd
Abingdon
OX14 3DB
England

Appendix 4.1 National Standards Bodies

Austria
Österreichisches Normungsinstitut (ON)
Postfach 130
Heinestraße 38
A-1021 Wien
tel: +43 1 213 00
fax: +43 1 213 00 650

Belgium
Institut Belge de Normalisation/ Belgisch Instituut voor Normalisatie (IBN/BIN)
Avenue de la Brabançonnelaan 29
B-1000 Bruxelles/Brussel
tel: +32 2 738 00 90

fax: +32 2 733 42 64

Denmark
Dansk Standard (DS)
Baunegaardsvej 73
DK-2900 Hellerup
tel: +45 39 77 01 01
fax: +45 39 77 02 02

Finland
Suomen Standardisoimisliitto
r.y. (SFS)
PO Box 116
FIN-00241 Helsinki
tel: +358 0 149 93 31
fax: +358 0 146 49 25

France
Association Française de Normalisation (AFNOR)
Tour Europe
F-92049 Paris la Défense
tel: +33 1 42 91 55 55
fax: +33 1 42 91 56 56

Germany
Deutsches Institute für Normung
e.V. (DIN)
D-10772 Berlin
tel: +49 30 26 01 0
fax: +49 30 26 01 12 31

Greece
Hellenic Organization for Standardization (ELOT)
313, Acharnon Street
GR-11145 Athens
tel: +30 1 228 00 01
fax: +30 1 202 07 76

Iceland
Icelandic Council for Standardization (STRI)
Keldaholt
IS-112 Reykjavik
tel: +354 587 70 02
fax: +354 587 74 09

Ireland
National Standards Authority of Ireland (NSAI)
Glasnevin
IRL-Dublin 9
tel: +353 1 807 38 00
fax: +353 1 807 38 38

Italy
Ente Nazionale Italiano di Unificazione (UNI)
Via Battistotti Sassi, 11b
1-20133 Milano MI
tel: +39 2 70 02 41
fax: +39 2 70 10 61 06

Luxembourg
Inspection du Travail et des Mines (ITM)
Boite Postal 27
26, rue Zithe
L-2010 Luxembourg
tel: +352 478 61 50
fax: +352 49 14 47

The Netherlands
Nederlands Normalisatie-Instituut (NNI)
Postbus 5059
Kalfjeslaan 2
NL-2600 GB Delft
tel: +31 15 269 03 90
fax: +31 15 269 01 90

Norway
Norges Standardiseringsforbund (NSF)
PO Box 353 Skøyen
N-0212 Oslo
tel: +47 22 04 92 00
fax: +47 22 04 92 11

Portugal
Instituto Português da Qualidade (IPQ)
Rua C, Av. dos Tres Vales
P-2825 Monte da Caparica
tel: +351 1 294 81 00
fax: +351 1 294 82 22

Spain
Asociación y Certificación (AENOR)
Calle Fernández de la Hoz, 52
E-28010 Madrid
tel: +34 1 432 60 00
fax: +34 1 310 49 76

Sweden
Standardiseringen I Sverige
(SIS)
Box 6455
S-113 82 Stockholm
tel: +46 8 610 30 00
fax: +46 8 30 77 57

Switzerland
Schweizerische Normen-Vereinigung (SNV)
Mühlebachstraße 54
CH-8008 Zurich
tel: +41 1 254 54 54
fax: +41 1 254 54 74

United Kingdom
British Standards Institution (BSI)
389 Chiswick High Road
London W4 4AL
tel: +44 181 996 90 00
fax: +44 181 996 74 00

Appendix 4.2 Accreditation Bodies

Austria
Bundesministerium für wirtschaftliche
Angelegenheiten
Sektion IX (Akkreditierungsstelle des Bundes)
Landstraßer Hauptstraße 55-57
A-1031 Wien
tel: +43 1 711 02 253
fax: +43 1 714 35 82

Belgium
Ministry of Economic Affairs
Department of Quality and Security
Division Quality
BELCERT - Accreditation Service

Boulevard Emile Jacqmain 154
B-1210 Brussels
tel: +32 2 206 46 76
fax: +32 2 206 57 44

Denmark
DANAK
National Agency for Industry and Trade
Tagensvej 137
DK-2200 Copenhagen N
tel: +45 35 86 82 50
fax: +45 35 86 85 78

Finland
FINAS
Centre for Metrology and Accreditation
Lonnrotinkatu 37
P.O. Box 239
SF-00181 Helsinki
tel: +358 9 61 672 52
fax: +358 9 61 673 41

France
COFRAC
37 rue de Lyon
F-75012 Paris
tel: +33 1 44 68 82 20
fax: +33 1 44 68 82 21

Germany
DAU Deutche Akkreditierungs-und Zulassungs-
gesellschaft für Umweltgutachter m.b.H
Adenauerallee 148
D-53113 Bonn

Greece
Ministry for the Environment
Physical Planning and Public Works
Dept. of International Relations and the EU
17 Amaliados str.
GR-115 24 Athens
tel: +30 1 6465762/6411717
fax: +30 1 6434470

Ireland
NAB
The Irish National Accreditation Board
Wilton Park House
Wilton Place
IRL-Dublin 2
tel: +353 1 607 3003
fax: +353 1 607 3009
e.mail: john.hussey@nab.ie

Italy
ANPA
Agenzia Nazionale per la Protezione
dell'Ambiente
Dipartmento Strategie Integrale
Via V. Brancati 48
I-0144 Roma Eur
tel: +39 6 5007 2066
fax: +39 6 5007 2078

Luxembourg
Ministére de l'Environment
Montée de la Petrusse 18
L-2918 Luxembourg
tel: +352/478 68 16
fax: +352/40 04 10

Norway
Norwegian Accreditation
P.O. Box 6831 St. Olvas Plass
N-0130 Oslo
tel: +47 648-484 84
fax: +47 648 484 85

The Netherlands
RvA - Raad voor de Certificatie
Postbus 2768
NL-3500 GT Utrecht
tel: +31 30 23 94 500
fax: +31 30 23 94 539

Portugal
IPQ Instituto Português da Qualidade
Accreditation Department
Rua C Avenida dos Três Vales
P-2825 Monte de Caparica
tel: +351 1 294 81 00
fax: +351 1 294 81 01

Spain
ENAC
C/ Serrano
240 7th Floor
ES-28016 Madrid
tel: +34 1 457 32 89
fax: +34 1 458 62 80

Sweden
SWEDAC
Swedish Board for Accreditation and Conformity
Assessment
P.O. Box 878
Österlånggatan 5
S-50115 Boräs
tel: +46 3 317 77 00
fax: +46 3 310 13 92

United Kingdom
UKAS
United Kingdom Accreditation Service
Queens Road
Teddington
UK - Middlesex TW11 0NA
tel: +44 181 943 63 11
fax: +44 181 943 71 34

APPENDIX 4.3 EMAS COMPETENT BODIES

Austria
Bundesministerium für Umwelt
Referat Umweltkontrolle
Umweltbundesamt
Spittelauer Lände 5
A-1090 Wien
tel: +43 1 313 04 55 42
fax: + 43 1 313 04 54 00
e-mail: girginker@ubavie.gv.at

Belgium
Vlaams Gewest

ANIMAL
Emile Jacqmain Laan 156-Bus 8
B-1000 Brussel
tel: +32 2 507 30 10
fax: +32 2 507 67 65

Brussels Gewest
IBGE - Institut Bruxellois de Gestion de l'Environnement
Gulledelle 100
B-1200 Bruxelles
tel: +32 2 775 75 82
fax: +32 2 775 76 79

Waals Gewest
Ministére de al Région Wallonne
Direction Génerale des Ressources Naturelles et de l'Environnement
Av. Prince de Liège 15
B-5100 Jambes
tel: +32 81 32 12 11
fax: +32 81 32 59 84

Federaal Niveau
Federaal Agentschap voor Nucleaire Controle
p/a J.P. Samain, Directeur-Generaal Federaal
Ministerie Leefmilieu en Volksgezondheid
R.A.C. Vesaliusgebouw 2/3
Bureau V2/3-27
B-1010 Brussel
tel: +32 2 210 49 75
fax: +32 2 210 49 67

Denmark
Environmental Management Council
Danish Environmental Protection Agency (EPA)
Strandgade 29
DK-1401 Copenhagen
tel: +45 32 66 01 00
fax: +45 32 66 04 79

Finland
Finnnish Environment Institute
Kesäkatu 6
P.O. Box 140
SF-00251 Helsinki
tel: +358 0 403 007 09
fax: +358 1 403 00790
e.mail: titta.schultz@vyh.fi

France
Ministère de l'Environnement
Comité de Suivi du Réglement Eco-Audit
20 Avenue de Ségur
F-75302 Paris 07 SP
tel: +33 1 42 19 14 39
fax: +33 1 42 19 14 67

Germany
In Germany, chambers of commerce and industry undertake the task of registration. Around 40 chambers are involved. Address below is a contact point

Bundesumwelt Ministerium
Kennedy Allee 5
D-53117 Bonn
tel: +49 228 305 2256
fax: +49 228 305 2225

Greece
Competent body not yet appointed. For further information contact:

Ministry for the Environment, Physical Planning and Public Works
Dept of International Relations and the EU
17, Amaliados str.
GR-115 24 Athens
tel: +30 1 6465762 or 6411717
fax: +30 1 6434470

Ireland
NAB - The Irish National Accreditation Board
Wilton Park House
Wilton Place
IRL - Dublin 2
tel: +353 1 607 30 03
fax: +353 1 607 31 09

Italy
ANPA - Agenzia Nazionale per la Protezione dell'Ambiente
Dipartimento Strategie Integrale
Settore Qualità Ambientale Impresse
Via V. Brancati 48
I-0144 Roma Eur
tel: +39 6 5007 2066
fax: +39 6 5007 2078

Luxembourg
Ministére de l'Environnement
Montée de la Petrusse 18
L-2918 Luxembourg
tel: +352 478 68 16
fax: +352 40 04 10

The Netherlands
SCCM
Postbus 18505
NL-2502 EM Den Haag
tel: +31 70 362 39 81
fax: +31 70 363 50 84

Norway
Norwegian Pollution Control Authority
PO Box 8100 Dep.
N-0032 Oslo
tel: +352 478 68 16
fax: +352 40 04 10

Portugal
Direcção - Geral Ambiente
Rua da Murgueira
Bairro do Zambujal
P-2670 Buraca
tel: +351 1 472 82 00
fax: +351 1 471 90 76

or

Direcção Geral da Industria
Av. Conselheiro Fernando de Sousa no 11 - 4o Andar
P-1092 Lisboa
tel: +351 1 385 91 61
fax: +351 1 69 10 42

Spain
Minesterio de Medio Ambiente
Plaza San Juan de la Cruuz, s/n
ES-28071 Madrid
tel: +34 1 597 64 23
fax: +34 15 816

Sweden
Swedish EMAS council
World Trade Centre
PO Box 703 96
S-107 24 Stockholm
tel: +46 8 405 20 50
fax: +46 8 98 99 02
e-mail: ryding@miljostyrning.se

United Kingdom
UK Competent Body for the Eco-Management
and Audit Scheme
Department for the Environment
Floor 6/E10 Ashdown House
123 Victoria
London SW1P 3EB
tel: +44 171 276 05 94
fax: +44 171 276 47 39

5. Environmental auditing

5.1. What is an environmental audit?

An ***environmental audit*** is a tool that is used to check whether a company is doing what it should be doing.

Environmental auditing originated in North America in the 1970s as a management tool to determine whether or not companies were complying with the increasingly numerous and complex laws and regulations that were coming into force at that time. Checking whether the activities of your company that are covered by environmental legislation (i.e. what your company is doing) actually comply with that legislation (i.e. what is should be doing) is called a *legislative compliance audit*.

Both EMAS and ISO 14001 require companies to carry out an *environmental management system audit*. This means that a company must check to see whether its environmental management system fulfils the requirements of these documents.

Perhaps your company has a waste management policy, or has agreed to abide by its industry sector guidelines on waste management. In this case your company may want to carry out an audit to check that its waste management activities conform with the requirements of its policy or the industry sector guidelines. Or maybe your company has in place certain procedures for carrying out important operations. In this case you may want to carry out an audit to check that the relevant staff members are adhering to these procedures.

Perhaps your company is thinking of purchasing another company. In this case it may want to do a *preacquisition audit* to check, for instance, that this company is doing what it should be doing in terms of complying with all relevant legislation and any industry guidelines which it has signed up to.

Some audit terminology

Whatever it is that is being audited - e.g. activities covered by legislation, your EMS, your waste management practices - is referred to as the *subject matter* of the audit. The policies, procedures, guidelines, standards or other requirements against which the subject matter of the audit is checked are called *audit criteria*. So we can say that

An environmental audit seeks to determine whether or not the audit *subject matter* conforms with the *audit criteria*.

For example, the audit criteria in a legislative compliance audit will be the environmental legislation that applies to your company and the subject matter of the audit will be the environmental activities and conditions

covered by this legislation. And in an environmental management system audit, the subject matter of the audit will be your company's EMS and the audit criteria will be the requirements of EMAS or ISO 14001.

How does an auditor determine whether or not the subject matter of the audit conforms with the audit criteria?

In order to determine whether or not the audit subject matter conforms with the audit criteria an auditor has to collect *audit evidence* - which is defined as *verifiable information, records or statements of fact*. The important point to make here is that the audit process involves using *existing* information to determine conformity - auditors do not go out and generate new information.

Take the example of a legal compliance audit. If, for instance, the emissions of a particular substance from a chimney or stack are required by law to be less than so many parts per million, then an auditor will examine existing monitoring records to see whether the emissions are within legal limits. If the emissions have not been monitored then the auditor will conclude that there is insufficient audit evidence to verify compliance. The auditor will *not* measure the emissions from the stack himself or herself in order to see if the emissions are within the required limits.

An environmental audit consists of *collecting and assessing audit evidence* in order to determine whether or not the audit subject matter conforms with the audit criteria.

If an auditor does not think enough evidence exists to undertake an audit, then the audit should not take place. ISO 14010 - the international standard on the general principles of environmental auditing - is very clear that an audit should take place only if "*there is sufficient and appropriate information about the subject matter of the audit*".

The parties involved in an audit

The following terms are used to describe those parties involved in an audit:

- *Auditee* - the organization to be audited
- *Audit team* - the group of auditors, or a single auditor designated to perform a given audit. The leader of the team is known as the *lead auditor*
- *Client* - the organization commissioning the audit

Table 5.1 shows how these terms apply in different situations

Situation	Audite e	Audit Team	Client	Audit description
A company (C) undertaking routine internal audits	C	C	C	Internal, first party
A retailer (R) undertaking audits of a supplier (S) using its own auditing staff.	S	R	R	External, second party
A company (C) commissioning audits of a waste contractor (W), by an auditing organization (A)	W	A	C	External, third party

A certification body (B) auditing the EMS of a company (C) seeking certification to ISO 14001	C	B	C	External, third party

Table 5.1 The use of audit terminlogy in various audit situations[i]

5.2. Why carry out environmental auditing?

The simple answer is that it is always important to check that things are as they should be. Given that your company must comply with relevant environmental legislation and regulations, it is obviously important that your organization checks that it is actually in compliance. Only by auditing will you discover instances of non-compliance and be able to correct them.

If your firm is planning to purchase another firm it is important to know that this firm is complying with all relevant environmental legislation and all relevant codes of practice/guidelines. If it is not, then you may decide that it represents too much of a liability to purchase.

And if you have decided to develop and implement an environmental management system it is important that you have an effective internal audit procedure to ensure that you are meeting the requirements of the standard. This is particularly important if you want to have your EMS certified. Accredited certifiers can only certify your management system "*if your internal audit system is fully operational and can be shown to be effective*."[ii]

As mentioned previously in this handbook, the environmental management system is likely to becoming increasingly important management tool in the future. In recognition of this fact, ISO gave priority to writing a standard on environmental management system auditing (ISO 14011). Given the likely future importance of environmental management systems, it may be helpful to your company to have some knowledge of EMS auditing. The next section therefore describes the process of carrying out an EMS audit.

5.3. How does my company carry out an EMS audit?

Both EMAS and ISO 14001 require companies to periodically carry out an audit of their environmental management system. These audits can be carried out by competent company staff or by external auditors.

If your company does not have suitably qualified in-house auditors it has two choices - it can either employ external auditors or get one/some of its staff trained in the necessary auditing skills. (Guidance on the type and level of education, work experience and training required to become an auditor is set out in ISO 14012). It is probably cheaper in the long run to get staff trained as auditors, rather than continually paying external auditors to audit your EMS.

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[i] Hunt, D and Johnson, C (1995) *Environmental Management Systems: Principles and Practice*, McGraw Hill

[ii] European Accreditation of Certification (1996) *Guidelines for the Accreditation of Certification Bodies for Environmental Management Systems*

And in addition, having in-house expertize will allow your firm to be more fully involved in maintaining its EMS and to more fully own the EMS process.

In order to give an idea of what an audit of your environmental management system would involves, an outline of the process is set out below. This description is based on the guidelines contained in ISO 14011, the international standard on environmental management system auditing. (**Note**: The ISO 14011 guidance is based on the 7 principles of environmental auditing laid down in ISO 14010. These principles are set out in Appendix 5.1.)

The EMS audit process

An EMS audit can be divided into 4 stages (see Figure 5.1)

1. initiating the audit
2. preparing the audit
3. executing the audit
4. audit reports and records

The various elements within each stage are discussed below.

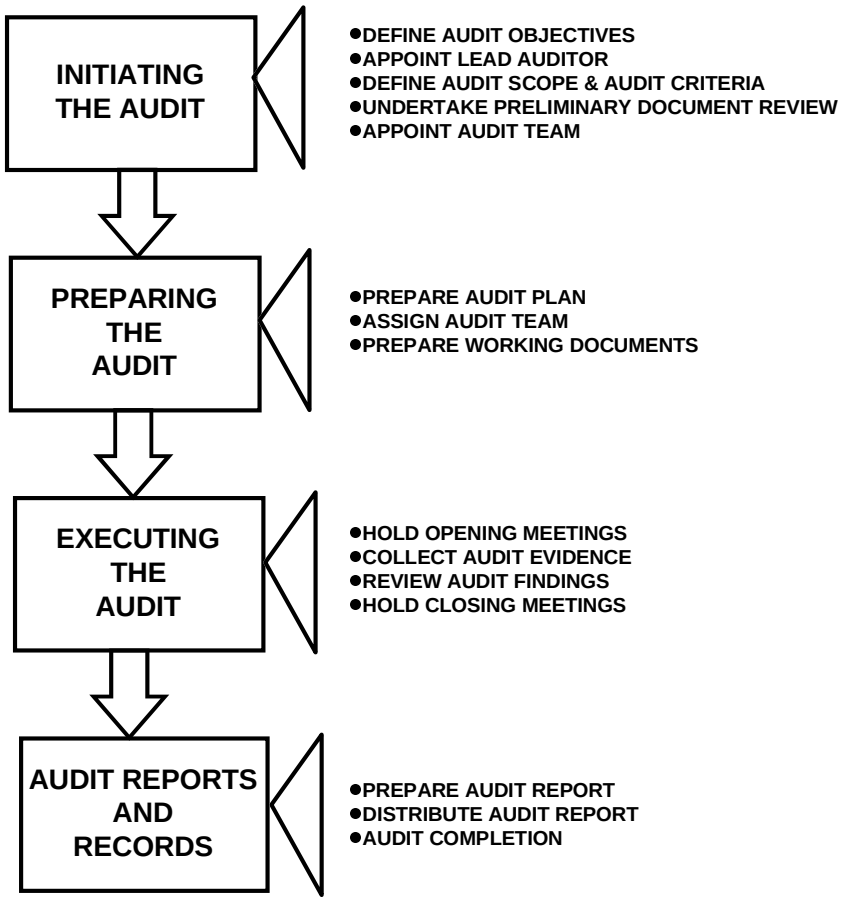

Figure 5.1 The EMS audit process

1. Initiating the audit

Define audit objectives
The first step in the auditing process is to define the objectives of the audit. According to ISO 14011 it is the responsibility of the client (i.e. the organization commissioning the audit) to set the audit objectives. In this case it is your company that is commissioning the audit and ultimately it is up to the head of the company (referred to subsequently as the MD - Managing Director) to approve the audit objectives. If the audit is routine then its objective will be to determine whether your company's EMS (or a particular part of it) conforms to the relevant EMS requirements (e.g. those of ISO 14001 or EMAS) and had been properly implemented and maintained. However an audit may also be non-routine. Previous audits may have revealed frequent instances of non-conformance in a particular area of operations and an audit may be initiated to check the success of corrective actions.

Appoint the lead auditor
The next step in the audit process is the appointment of the lead auditor by your MD. The lead auditor will either be an external auditor or one of your employees who has been trained to fulfil this role (in many companies this is the environmental manager). Even though the person appointed as lead auditor may be an employee that your MD knows well, it is still important that he/she is appointed formally (for instance by an official letter or memo from your MD) rather than informally over a cup of coffee or by a phone call. If you wish to have your EMS certified/verified, the certifier/verifier will want to see evidence that proper audit procedures have been followed, so throughout the audit process it is important that such evidence is generated.

Defining the audit scope and the audit criteria
The lead auditor and your MD should consult to define the audit scope and the audit criteria. It may be decided that the audit should be carried out in phases rather than the whole EMS being audited in one go. Your company may want to audit by operational area (i.e. auditing a proportion of operational areas at each audit phase) or it may want to audit by requirement (i.e. auditing against selected requirements of ISO 14001/EMAS at each audit phase).

Preliminary document review
The lead auditor needs to review the company's EMS documentation - e.g. environmental policy statements, programmes, records and manuals in order to assess whether or not there is sufficient and appropriate information about the EMS to undertake the audit. If the lead auditor judges that there is not, then he/she must inform your MD.

Appointing the audit team
Having decided that the audit can go ahead, the lead auditor should, if they are needed,, appoint other auditors to assist in carrying out the audit. These appointments to the audit team need to be approved by your MD. Depending on your company's approach, the audit team will consist of either external auditors or staff members that have received the necessary auditing training.

2 Preparing the audit

Audit plan
The lead auditor should prepare an audit plan in consultation with the MD and any audit team members. The plan should include, if applicable

a) the audit objectives and scope
b) the audit criteria
c) identification of the organizational units to be audited
d) identification of those elements of the EMS that are of high audit priority
e) the audit procedures to be used
f) identification of reference documents
g) the expected time and duration for major audit activities
h) the dates and places where the audit is to be conducted
i) identification of audit team members
j) the schedule of meetings to be held with management
k) confidentiality requirements
l) content, format, structure, expected date of issue and distribution of the audit report
m) document retention requirements

Audit team assignments
The lead auditor, in consultation with audit team, should assign the various members to specific EMS elements or activities and instruct them on the audit procedures to be followed.

Working documents
The lead auditor needs to coordinate the preparation of the working documents required to undertake the audit. These may include

- forms for documenting supporting evidence and audit findings
- procedures and checklists used for evaluating EMS elements
- records of meetings

3 Executing the audit

Opening meeting
This stage of the audit should start with an opening meeting. The purpose of the opening meeting is to:

a) introduce the members of the audit team to your company's management;
b) review the scope, objectives and audit plan and agree on an audit timetable;
c) provide a short summary of the methods and procedures to be used to conduct the audit;
d) establish the official communication links between the audit team and your MD;
e) confirm that the resources and facilities needed by the audit team are available;
f) confirm the time and date for the closing meeting;
g) promote the active participation of company staff in the audit;
h) review relevant site, safety and emergency procedures for the audit team.

Collecting evidence
Sufficient audit evidence should be collected to be able to determine whether or not your EMS conforms to the EMS audit criteria. Audit evidence should be collected through:

- interviews
- examination of documents
- observation of activities and conditions

Information gathered through interviews should be verified by acquiring supporting information from independent sources, such as observations, records and results of existing measurements. Non verifiable information should be identified as such. Auditors should examine the basis of relevant sampling programmes and the procedures in place for ensuring effective quality control of sampling and measurement processes. Indications of non-conformity with any EMS audit criteria should be recorded.

Auditing findings
Having collected the audit evidence, the audit team needs to review it in order to determine instances where the EMS does not conform to the audit criteria. The non-conformities should be documented in a clear, concise manner and supported by audit evidence. The audit findings should be reviewed with the person responsible for the EMS with a view to obtaining acknowledgement from him/her of the factual basis of all findings of non-conformity.

Findings of conformity can also be documented, if within the agreed scope of the audit. However care needs to be taken that no absolute assurance of conformity is given or implied. As pointed out in section 5.1, it is not possible to give such an assurance as the audit will inevitably be based on a limited examination of the EMS and its implementation.

Closing meeting
Prior to preparing the audit report, the audit team should hold a meeting with your MD and those responsible for the functions audited (e.g. relevant site/line/plant managers). The main purpose of this meeting is for the team to present the audit findings to your management with a view to ensuring that they are fully understood and to obtaining an acknowledgement of the factual basis of the findings.

The closing meeting is an opportunity to resolve any disagreements between the auditing team and your MD. The final decision on the significance and description of the audit findings rests with the lead auditor, though your MD may disagree with these findings.

4 Audit reports and records

Audit report preparation
The audit report is prepared under the direction of the lead author, who is responsible for its accuracy and completeness. The topics to be addressed in the report should be those determined in the audit plan. Any changes to these topics which are desired at the time of preparation of the report should be agreed by the all the parties concerned.

The audit report should contain the audit findings (or a summary of these findings) with reference to supporting evidence. Subject to agreement between the lead auditor and your MD, the audit report may also include the following:

a) the identification of the organization audited and of the client
b) the agreed objectives, scope and plan of the audit
c) the agreed audit criteria including a list of reference documents against which the audit was conducted
d) the period covered by the audit and the date(s) the audit was conducted
e) the identification of the audit team members
f) a statement of the confidential nature of the report contents
g) the distribution list for the audit report
h) a summary of the audit process including any obstacles encountered
i) audit conclusion i.e. EMS fully conforms/does not fully conform with audit criteria and has/has not been properly implemented and maintained.

The audit report should be dated and signed by the lead auditor.

Report distribution
The audit report should be sent to your MD by the lead author. Distribution of the audit report should be determined by the your MD in accordance with the audit plan. Audit reports are the sole property of your company and confidentiality should be respected and appropriately safeguarded by the auditors and all recipients of the report.

The audit report should be issued within the agreed time period in accordance with the audit plan. If this is not possible, the reasons for the delay should be formally communicated to your MD and a revised issue date established.

All working documents, and draft and final reports pertaining to the audit should be retained by agreement between the your MD, the lead auditor and in accordance with any applicable requirements.

Audit completion
The audit is completed once all activities defined in the audit plan have been concluded.

Case study 5.1 - Beacon Press[iii]

Beacon Press, a printers in East Sussex is both certified to BS 7750 and registered under EMAS. The prospect of undertaking an audit to check they were complying with the requirements of these schemes was initially rather daunting for the company. As Managing Director Mark Fairbrass says "*I am sure a lot of companies feel like this. It was difficult for us until we stopped panicking, sat down and thought it all through very slowly and carefully*".

In order to carry out the audit, the Managing Director set up an audit team that included the company's environmental and quality mangers as well as outside

[iii] Case Study Overview, UK Competent Body for EMAS, Department of the Environment

consultants, who were called in to help with on-site training. To help them carry out the audit, the company thought of itself as enclosed within a plastic bubble, and everything that went in and out of the building, from employees and telephone cables, to mail and emissions, had to pass through the bubble for scrutiny. "*It was a very simple way of focusing our minds on every aspect of our activities*" says Mark Fairbrass "*and it proved to be a searching audit*".

To assist in the auditing process, a series of checklists were prepared for recording details of the operational effectiveness of the environmental management system, for identification of instances of non-compliance and for recording suggestions for improvements. The results were used in the preparation of the audit report and the information in the report was fed back into the management system in order to promote continuous improvement in environmental performance.

Appendix 5.1

The 7 principles of environmental auditing

ISO 14010 sets out 7 general principles that should govern the environmental audit process.

1. Objectives and scope
An audit should be based on objectives defined by the client. The scope of the audit (i.e. its extent and boundaries) is determined by the lead auditor and must be adequate to meet the audit objectives. The objectives and scope of the audit should be communicated to the auditee prior to the audit.

2. Objectivity, independence and scope
An environmental audit should be as objective as is possible. In order to ensure this, the members of the audit team should be independent of the activities they are to audit. If an internal audit is being performed (i.e. the audit team consists of employees of the company being audited) then none of the audit team members should be accountable to those directly responsible for the subject matter being audited.

The audit team members should, of course, have the knowledge, skills and experience necessary to carry out the audit. Guidance on these matters is provided in ISO 14012, the international standard on qualification criteria for environmental auditors.

3. Due profession care
a) When conducting an audit, auditors should exercise the care, diligence, skill and judgement expected of any auditor in similar circumstances.
b) The audit team/client relationship should be one of confidentiality and discretion. Unless required to do so by law, the audit team should not disclose information/documents obtained during the audit or the final audit report to any third party without the approval of the client.
c) The audit team should follow procedures that provide for quality assurance.

4. Systematic procedures
To enhance consistency and reliability, an environmental audit should be conducted according to documented and well-defined methodologies and systematic procedures. It should be carried out it accordance with any guidelines developed for that particular type of environmental audit. (For example ISO have published guidelines for conducting environmental management system audits - ISO 14011.)

5. Audit criteria, evidence and findings
Audit criteria should be determined at an early stage of the audit process. They should be agreed between the lead auditor and the client and communicated to the auditee. Audit evidence should then be collected and evaluated in order to determine whether the audit criteria have been met.

6. Reliability of audit findings and conclusions
The audit evidence collected during an environmental audit will inevitably only be a sample of the information available, as audits are conducted over a limited period of time and with limited resources. There will therefore be an element of uncertainty inherent in all audits and the users of the results of environmental audits should be aware of this uncertainty. The auditing process should be designed to provide the client with the desired level of confidence in the reliability of the audit findings.

7. Audit report
The client should be provided with a written report of the audit findings (and/or a summary thereof). Unless the client states otherwise, the auditee should also receive a copy of the report. Information that may be contained in an audit report includes (but is not limited to)

a) the identification of the organization audited and of the client
b) the agreed objectives and scope of the audit
c) the agreed criteria against which the audit was conducted
d) the period covered by the audit and the date(s) the audit was conducted
e) the identification of the audit-team members
f) the identification of the auditee's representatives participating in the audit
g) a statement of the confidential nature of the contents
h) the distribution list for the audit report
i) a summary of the audit process including any obstacles encountered
j) the audit conclusions

The lead auditor, in consultation with the client, should determine which of these items, together with any additional items, should be included in the report. Normally it is the responsibility of the auditee to determine any corrective action need in the light of the audit findings. However the auditor may provide recommendations when there has been prior agreement to do so with the client.

Further Information

Environmental Management Systems: Principles and Practice (Hunt and Johnson, McGraw Hill, 1995) pp 210-231.

6. Environmental Indicators

6.1. What are environmental indicators?

Environmental indicators express useful and relevant information about a firm's environmental performance and its efforts to influence its performance.

So what is environmental performance? Environmental performance can be defined as:

> *the results of an organization's management of its environmental aspects*

and, as noted in Chapter 4, an environmental aspect is

> *an element of an organization's activities, products or services that can interact with the environment.*

Examples of indicators include:

- Tonnes of SO_2 released per year
- Tonnes of CO_2 released per unit of production
- Litres of water used per year
- Kilogrammes of hazardous waste produced per year
- Number of legislative breaches per year
- savings achieved through energy efficiency measures
- number of environmental improvement suggestions from employees and number taken up by management
- number of complaints received about environmentally related matters
- number of employees trained versus number needing training

6.2. Why use indicators?

There are a number good reasons for using indicators:

- Using indicators to measure your firm's environmental performance is necessary to determine whether or not it is complying with the relevant legislation.
- Indicators enable you to track your performance over time. For example an environmental review (see Box 4.1) may have identified a number of areas where measures can be taken that will improve your environmental performance in a cost effective manner. By using EPIs you will be able to measure exactly how much your performance has improved after these measures have been implemented.

- Perhaps your firm has set itself some environmental targets. By using indicators to measure your performance you will be able to know whether you have successfully met those targets.
- Indicators can signal areas where attention is needed. A significant change in an indicator reading relating to an environmental aspect can indicate a problem in an operational process or the procedures governing that process.
- Not only do indicators measure environmental performance, they can measure management's efforts to improve performance. This information provides useful feedback for management, employees and shareholders.
- Increasingly, stakeholders are wanting firms to provide information about their environmental management and environmental performance. Your local community may want the information to reassure itself about the safety or your activities and potential investors may want the information to assure themselves that your firm is a sound investment. By selecting the appropriate indicators your company can generate the information it needs to satisfy its various stakeholders.

Box 6.1 ISO and indicators

ISO is currently writing a guidance standard (ISO 14031) on environmental performance evaluation (EPE). Environmental performance evaluation is defined as a

process to facilitate management decisions regarding an organization's environmental performance by selecting indicators, collecting and analyzing data, assessing information against environmental performance criteria, reporting and communicating and periodic review and improvement of this process..

This standard gives guidance to firms on developing indicators with which to measure their environmental performance and their efforts at improving their performance. A firms can then use these indicators to determine whether or not it has met any targets and objectives it may have set for itself. The standard also contains guidance on reporting environmental performance to stakeholders (environmental reporting is covered in Chapter 10). This standard is equally applicable to firms that have an EMAS/14001 management system and those that do not.

Both EMAS and ISO 14001 require firms to set objectives and targets in order to bring about continuous improvement in their environmental performance. This requires the developments of indicators. However neither document gives guidance on how to develop appropriate environmental indicators within a company. ISO 14031 complements EMAS and ISO 14001 by providing this guidance. In addition ISO 14031 gives a large number of examples of indicators that companies may wish to use or adapt.

6.3. How does my firm develop and use suitable indicators?

This section shows how a company can get started in designing and choosing its environmental indicators and has 5 parts:

- 6.3.1 describes the three indicator areas and associated indicators

- 6.3.2 looks at the various types of indicators
- 6.3.3 offers some guidelines for choosing indicators
- 6.3.4 provides an indicator starter pack
- 6.3.5 briefly describes how companies can use existing information systems to gather data required to develop indicators.

6.3.1. The three indicator areas

ISO 14031 sets out 3 indicator areas - the operational and management areas of a firm and the environment - see Figure 6.1. These areas and their associated indicators are described below.

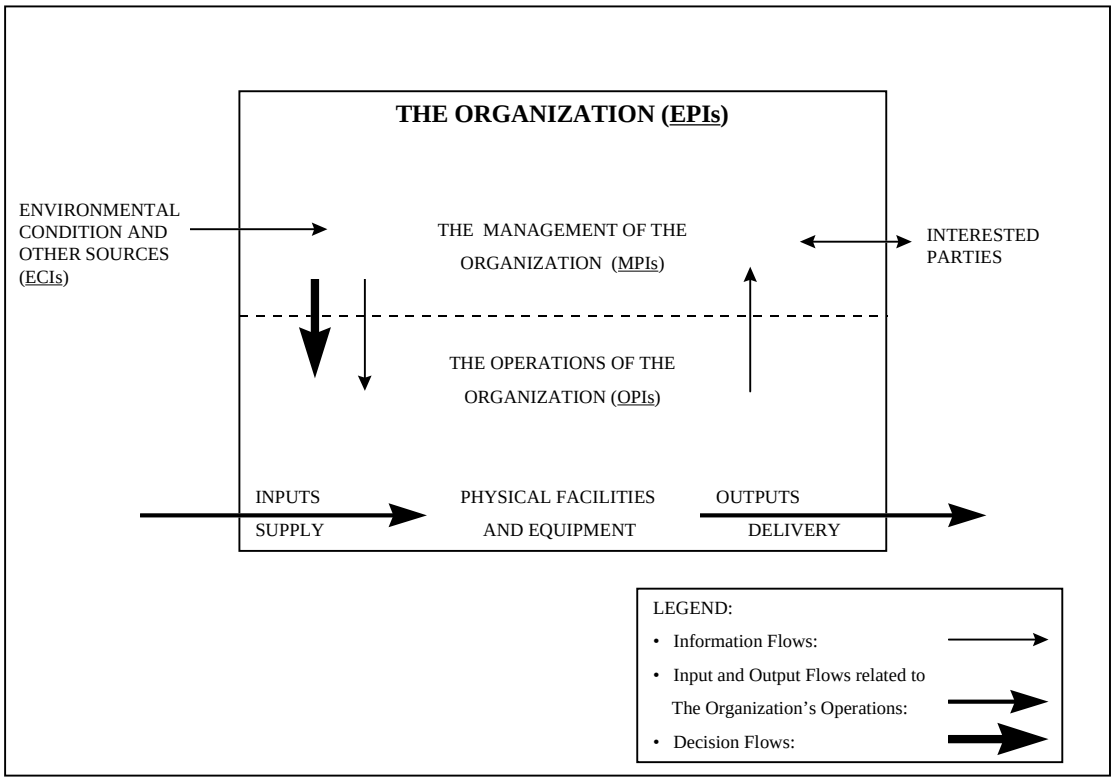

Figure 6.1 Interrelationships of an organization's management and operations, and the condition of the environment [i].

The operational area and OPIs

The operational area consists of the operations of the firm's physical facilities and equipment i.e. those activities that have an environmental aspect. Examples of operational activities include manufacturing processes, the heating and lighting of buildings, transport activities, the operation of office equipment. As the activities in the operational area are those which have

[i] International Organization for Standard ISO 14031 (1998), ISO/CD 14031, *Environmental Performance Evaluation - Guidelines*, International Organization for Standard, Geneva. Please note that the figure is taken from a draft document and may be subject to change. Reproduced with the permission of BSI under licence no. PD\1998 0643. Complete editions of standards can be obtained from national standard bodies.

environmental aspects, they are the activities that determine the firm's actual environmental performance.

The indicators used to measure the environmental aspects of operational activities are known as ***operational performance indicators (OPIs)***. Examples of OPIs include:

- Total energy use per year
- Waste production per year
- Emissions of NO_x per unit of production
- Water use per unit of production

The management area and MPIs

The management area consist of the various planning, administrative and decision-making processes that make up management. Management decisions relating to the environment include:

- deciding how much money to spend on environmental management actives
- deciding how much training to provide to employees
- deciding whether to develop an environmental management system

Obviously management activities can have a considerable influence on the actual environmental performance of the firm. The indicators used to measure management activities relating to the environment are called ***management performance indicators (MPIs)***. Examples of management performance indicators include:

- number of environmental objectives and targets achieved
- number of employees trained
- number of suppliers and contractors questioned about their environmental management practices
- frequency of review of operating procedures

One important category of MPIs is *financial indicators.* Financial indicators aim to measure the effects of environmental management activities on a firm's financial performance. (The aim here is to integrate the environmental dimension of a firm's activities into traditional cost accounting and business management considerations.) Examples of financial indicators include:

- cost (both capital and operational) over time of activities related to environmental performance
- savings achieved over time through waste recycling, reductions in resource use or resource substitution
- return on investment for environmental improvement projects

Note: Operational performance indicators and management performance indicators are referred to collectively in ISO 14031 as ***environmental performance indicators (EPIs)***.

The environment and ECIs

As their name suggests, ***environmental condition indicators (ECIs)*** measure the condition of the environment. Examples of ECIs include:

- contaminant concentration in air/groundwater/surface water/soil/plant tissue/ animal tissue
- number of coliform bacteria per litre of water
- odour measured at specific distance from the organization's facility

Whereas OPIs measure a company's environmental aspects, ECIs can be used to measure a company's actual impact on the environment i.e.

> *any change to the environment, whether adverse of beneficial, wholly or partially resulting from an organization's activities, products or services.*

The link between environmental aspects and environmental impacts in one of cause and effect i.e. environmental aspects are the cause of environmental impacts (see Table 6.1) It is possible to use indicators to measure both an environmental aspect and its related impact. For instance, the environmental aspect of phosphate emission can be measured using the OPI

> *quantity of phosphates emitted per unit of time*

the associated impact can be measured using the ECI

> *the biological oxygen demand (BOD) caused by these phosphate emissions in the receiving aquatic environment*

Measuring environmental impacts can be very costly and in many cases it is just not possible to tell how much of a particular environmental impact is caused by one firm as opposed to one or more other firms within the same area. Most companies confine themselves to using OPIs in the knowledge that managing their environmental aspects will reduce the firm's environmental impact.

Company environmental aspects (examples)	Environmental impacts	Implications for society
CO_2 emissions	Climate change, the greenhouse effect	Flooding of coastal areas, changes in agricultural conditions, population migration from affected areas
CFC and halon emissions	Depletion of the ozone layer	Skin cancer, effects on agriculture
Nitrogen and phosphates emissions	Eutrophication of lakes and rivers	Reduced fisheries, algae growth, potential toxification of surface water
SOx, NOx, and NH_3 emissions	Acidification of surface water and rain, tree death, deterioration of urban environmental quality	Forest death, loss of architectural heritage, health effects on urban population
Heavy metal emissions	Toxic contamination of soil	Human health effects including loss of reproductive capability and cancer risk
Intensive land use, land conversion, land fragmentation	Biodiversity	Loss of pest resistance of ecological systems, loss of potential genetic resources
Water use	Demand on surface or	Potential water shortage,

	ground water resources	potential conflict issue.

Table 6.1: The relationship between company environmental aspects, environmental effects and implications for human society.

6.3.2. Types of EPIs

There are 4 types of indicators

- absolute indicators
- relative indicators
- aggregated indicators
- indexed and weighted indicators

Absolute indicators

Absolute indicators measure basic data. Examples of absolute indicators include:

- Tonnes of CO_2 emitted per year
- Tonnes wastes generated per year
- Litres of cooling water used per year

Whilst absolute indicators provide useful information, care must be taken not to draw false conclusions from this information. For example, the fact that CO_2 emissions in year 2 have fallen when compared to the emissions in year 1 does not necessarily mean that a firm's efficiency has improved. It could be that the level of production has remained constant and that CO_2 emissions per unit of output have fallen - but the fall in emissions may simply be due to a downturn in business i.e. the firm is operating at the same level of efficiency but producing less. If CO_2 emissions have fallen because of an increase in efficiency we could reasonably claim that environmental performance had improved. However, if efficiency had remained the same and it is just production that has fallen, such a claim would not be justified.

In the above example, we would need to know about CO_2 emissions per unit of production to make any claim about changes in efficiency. "CO_2 emissions per unit of production" is an example of a *relative indicator*.

Relative indicators

Relative indicators can be used by comparing absolute consumption or emission figures with meaningful reference data. They can be separated into efficiency ratios and quotas

- *efficiency ratios* describe the use of resources or the amount of emissions in relation to production inputs or production outputs, e.g. CO_2 emissions per unit of production, water use per unit of production or quantity of waste produced per unit of input material
- *quotas* describe the sub-section of a measure in relation to the whole measure, e.g. the proportion of company vehicles running on unleaded fuel.

Aggregated indicators

Aggregated indicators bring together data from a number of separate categories into a more general category. An example of an aggregated indicator is annual waste disposal. Annual waste disposal is a general category and consists of the sum of all the separate waste streams. Other examples of aggregate indicators include:

- Total energy consumption.
- Total hazardous waste produced.
- Total annual vehicle mileage.

Annual vehicle mileage, for example, is made up of the annual mileages of the different types of vehicles used (lorries, vans, cars) and the mileage done on different fuels (petrol, diesel, electric vehicles).

Aggregated indicators are useful as they can bring together a large amount of data and express it as a single value, thereby providing an overview of a particular area. However because aggregated indicators paint a broad picture there is a limit to how much detail they can show. If total vehicle mileage stays constant from one year to the next, then without a further breakdown of the figures one would not know that perhaps car mileage had fallen whilst lorry mileage had increased by the same amount (meaning that even though mileage stayed constant, overall fuel consumption increased). So whilst useful, aggregated indicators should be used to complement disaggregated indicators and not as an alternative.

Weighting and indexes

If a firm wishes, it can combine information on all of its environmental aspects into a single number representing its environmental performance. This is usually done by multiplying each aspect by a weighting relating to its environmental significance and then adding all the weighted aspects together. Weighting can be done using a simple scale like the one below.

Most significant aspect - weighting factor 10
Least significant aspect - weighting factor 1

Take the following example where a firm has 6 aspects - all of them emissions. The number representing its environmental performance is calculated by adding all the weighted emissions together.

Emission	Quantity of emission released per unit of production (A)	Weighting factor (B)	Weighted emission (AxB)
Emission A	200	4	800
Emission B	5000	2	10000
Emission C	700	10	7000
Emission D	4000	1	4000
Emission E	400	8	3200
Emission F	900	3	2700
			27700

The performance number obtained for one year can then be compared with the performance number for the previous year to see whether environmental performance has improved or deteriorated. This comparison of a piece of data to another baseline piece of data is known as indexing. Hence if the previous year's performance number was 32 400 then

$$\text{environmental performance index} = \frac{\text{current year' performance number}}{\text{previous year's performance number}}$$

$$= \frac{27700}{32400}$$

$$= 0.854$$

An index value of less than 1 means that the firm's environmental performance has improved when compared with the previous year. Conversely a value greater than 1 means that environmental performance has deteriorated.

It is generally accepted that there is no universal weighting scheme that will meet the needs of all firms. Weighting environmental aspects is to some extent a subjective factor (see Box 4.2) and judgements relating to the significance of environmental aspects will vary from firm to firm. (For example, a company in a smog laden city may put more emphasis on reducing emissions to air than a similar company located out of the city). Therefore each industry sector and/or company should develop a scheme that suits its particular circumstances.

6.3.3. Guide for choosing environmental performance indicators

In order to effectively measure your environmental performance you should make sure that the indicatorss you chose have the following attributes:

- *Reflect environmental legislation*
  Indcators should measure those areas of your operations that are covered by environmental legislation.

- *Reflect your firm's environmental policy*
  Indicators should measure your firm's performance in the areas covered in its environmental policy.

- *Cover all significant aspects*
  Indicators should measure all of your firm's significant environmental aspects. Guidance on evaluating significance is set out in Box 4.1

- *Reflect the concerns of stakeholders*
  It is important that your firms is aware of the concerns of its stakeholders regarding its environmental performance. Indicators should provide information on these areas of concern.

- *Suit the needs of end users*
  The EPIs should be appropriate to the needs of the person using them. For example some users (e.g. company management, investors) will want to see a small selection of aggregated EPIs that give a good overall picture of what is happening in the country. In this case it may be inappropriate to provide the end-user with the detailed data from a large number of absolute indicators. However other end-users (e.g. regulators) may require this basic data and find the information provided by a small selection of aggregated EPIs insufficiently detailed.

Case study 6.1 Ausburg Worsted Yarn Spinning Mill[ii]

Founded in 1836, Ausburg Worsted Yarn Spinning Mill is a German SME that produces textiles. The company uses the ecobalance tool (see Chapter 7) to analyze its material and energy flows in order to identify areas for improvement in its operations. The most important data resulting from the ecobalance is converted into relevant environmental indicators.

Environmental Indicators	Unit	1993	1994	1995
Heavy metal free dyes	%	35.2	35.3	40.0
Reutilization of spinning bobbins	%	—	3.5	8.5
Reutilization of transport packaging	%	—	8.3	11.9
Loss of primary raw material	%	6.7	5.4	4.8
Energy consumption	MWh	89,285	82,422	73,865
Water consumption for dyeing	m^3	249,670	241,450	219,010
Ecotex 100 Standard approved products	%	50	90	98
Residual waste	kg	158,014	102,598	81,658
Temporary limit value excesses	number	—	3	5
Environmental cost savings	£	—	—	100,000

The information provided by the indicator system about the company's current environmental performance can be used as the basis for setting future targets. The information generated by the indicator system in the future will allow the company to see whether these targets have been met.

Since 1994 the company has realized a number of cost savings by improving its resource efficiency. For example, the spinning bobbins and transport packaging returned to the company by customers are cleaned, checked and repaired by members of a local community project for later reuse by the company. This reuse saves the company around £10,000 per year. Technical improvements to machinery and the increased motivation and awareness of the staff regarding environmental matters have led to significant reductions in the loss of raw materials. This loss was reduced from 6.7% in 1993 to 4.8% in 1995 which resulted in savings of over £40,000. In total, over £100,000 per year has been saved by measures implemented on the basis of the company's ecobalance.

6.3.4. Indicator starter pack

This sub-section provides an indicator starter pack with lists of OPIs and MPIs that can be used to begin the process of measuring your environmental performance. These EPIs are of course only suggestions and may prove either unsuitable or inadequate for your company needs. In this case you should be

[ii] Case study prepared by Rainer Rauberger, Institut für Management and Umwelt, Ausburg, Germany

able to use the information contained within this chapter to develop your own indicators so as to replace or supplement the ones given here.

Operational performance indicators (OPIs)

This set of indicators can be used to measure the performance of a particular process or service, the performance across a site or the performance across the whole of your firm.

- quantity of raw materials used
- amount of energy consumed
- total use of water
- use of CFCs
- total quantity of waste produced
- emissions of CO_2
- emissions of NO_x
- emissions of SO_2

Measuring product performance
Your company may find it useful to use product indicators i.e. indicators where the data collected is expressed relative to production. All the above indicators can of course be made relative to production and you may also like to use the following two indicators:

- Quantity of packaging used/unit of production
- Proportion of product packing that is multi-use as opposed to single use.

Case study 6.2 illustrates how the Danish Steel Works A/S used product indicators to show the environmental aspects associated with the production of 1000kg of steel. The relevant data for these indicators was obtained using the ecobalance tool (see Chapter 7). Although it not an SME, the approach used by the company is certainly applicable to SMEs.

Case Study 6.2- The Danish Steel Works A/S

An example of a company that has focused on the environmental performance of its product is The Danish Steel Works A/S. It has produced an Environmental Declaration which shows the various inputs and outputs related production of 1000 kg of its product. The various product indicators used in the company's Environmental Declaration can be seen below:

Environmental Declaration 1995		
Type	**Plates**	**Bars**
Energy		
Electricity (kWh)	811	770
Natural gas (Nm^3)	77	46
Oxygen (Nm^3)	35	22
Other Gases (kg)	0.8	0
Metallurgic carbon (C) (kg)	15	14
Recycled heat (kWh)	102	83
Air		
Dust emissions (g)	145	123
Heavy metal consumption (g)	13	11
CO_2 (kg)	223	150
Water		
Tap water, consumption (m^3)	0.13	0.12
Cooling water, consumption (m^3)	3.3	1.8
Heavy metal discharged (g)	1.3	0.6
Waste products		
Deposited waste products (kg)	26	24
Recycled waste products (kg)	251	228
Ratios		
Industrial accidents (no./tonne)	0.00012	
Hours of absence due to industrial accidents (h/tonne)	0.0108	
Maximum emissions, dust ($\mu g/m^3$)	80	
Maximum emissions, heavy metals ($\mu g/m^3$)	7	
Recycling of waste products (% recycled/produced)	117	

Table 6.3: Net effect of 1 tonne of steel produced at Det Danske Stålvalseværk A/S

Management performance indicators (MPIs)

Management indicators provide information on management's efforts to improve company environmental performance. These indicators are of interest to:

- *company's managers* - enabling them to judge their own performance
- *shareholders* - enabling them to judge the quality of environmental management within the firm
- *employees* - allowing then to follow the actions of company management

We suggest that some or all of the following indicators be used:

- *Compliance with laws and regulations*
  The number of breaches of environmental legislation per year and the environmental, economic and legal consequences of these breaches.

- *Complaints*
  Number and character of complaints made by local communities, local authorities and other interest groups per year.
- *Environmental targets*
  The number of company targets achieved and explanations for why other targets where not achieved.
- *Employee training*
  The number of employees that have received environmental training.
- *Environmental management practices*
  The environmental management practices in your firm may be of interest to external parties. You should provide details on your management system structure (e.g. responsibilities, procedures) and tools in use (e.g. environmental audits, environmental reviews and life-cycle assessment).

Financial indicators

As profit is the most primary indicator of performance in business it is important to find a way of linking environmental performance to financial performance. Financial MPIs have two roles. They can be used:

1. for management control purposes in monitoring costs associated with environmental initiatives and activities.
2. to provide relevant information in any environmental reports that are published (see Chapter 10)

Care must be taken when defining and interpreting financial MPIs. Many business expenditures improve environmental performance. However the motivation behind this expenditure may have nothing to do with improving environmental performance. For example, the routine replacement of old equipment means the installation new, more efficient equipment. Although this new machinery uses less raw materials and generates less waste per unit of production it would be misleading to call this expenditure an environmental expenditure as the reason for it was the need to replace worn out plant rather than to improve environmental performance.

When interpreting environmental expenditures, one should not draw the conclusion that higher expenditures signals improved environmental performance as this is not necessarily the case. For example, higher waste disposal costs could mean that your company's efficiency has declined and that more waste is being produced per unit of production. An improvement in environmental performance may mean a reduction in environmental expenditure. For example a small expenditure on process improvement may result in a much larger decrease in waste disposal expenditure.

Despite the above difficulties in developing and interpreting financial indicators, we believe that, for the following reasons, their use is worthwhile.

- By going through the process of defining financial indicators a company achieves a better understanding of the links between environmental and financial performance.
- Certain financial environmental indicators can highlight issues that may need further attention.

- Disclosing financial environmental indicators in, for instance, environmental performance reports gives interested parties an indication about resource allocation to environmental managment activities within the company and how it compares with resource allocation to other areas.

We therefore suggest that a financial environmental indicator starter pack is composed of some or all of the following indicators:

- *Waste disposal costs*
  The cost of disposing of hazardous and non-hazardous wastes either on-site or off-site.
- *End-of-pipe investments*
  The cost of attaching abatement technology to existing processes. Examples include scrubbers, filters, and water treatment plants.
- *Environmental taxes and levies*
  The amount paid in taxes and levies each year. These include eco-taxes, energy levies, environmental insurance etc.
- *Liabilities*
  Environmental liabilities arising from past or present company activities.
- *Clean up costs*
  Clean up costs of land contaminated by company activities.
- *Environmental management costs*
  The major costs associated with environmental management in the firm. These may include:
    - Training of employees and managers in environmental matters
    - External advice such as environmental consultants, accountants and lawyers
    - Wages of environmental personnel

These indicators have been chosen for their ability to aid management control and because of the relative ease with which the relevant data can be collected. A company can of course move beyond these indicators. Case study 6.3 shows the financial indicators used by ICI. Although ICI is a multinational company its approach is equally applicable to SMEs

Case Study 6.3 ICI

The multinational chemical company ICI has published environmental performance reports since 1991. Included in those is a disclosure of the company's operating expenditures and capital expenditures. Despite the challenge inherent in defining what constitutes an environmental cost and investment, the company feels that compiling information about the financial aspects of its environmental management activities signals company commitment to environmental improvements. The company uses four main financial indicators:

- amount spent environmentally sound products and processes
- amount spent incorporating environmental considerations into the construction of new plants
- amount spent dealing with the generation of waste
- amount spent cleaning up contaminated land and ground water

As environmental performance improves the amount spent in these areas should become lower. Or as stated in ICI's 1994 Environmental Performance Report: "*The most successful chemical companies will be those that reduce their environmental costs through resolving historical problems, running clean plants and developing environmentally sound products*".

6.3.5. Data sources for environmental performance information

Your company may already collect a certain amount of data specifically related to its environmental activities. Additional environmental data needed to develop relevant indicators may in many cases be collected by other *company information systems*. (By company information systems we mean those systems that collect and organize the various sorts of information required by a company e.g. the accounting system, the production planning system, the employee database etc.) However, often the environmental data held in these systems is not recognized as such and so goes unused.

It is therefore important when developing an environmental performance measurement system that environmental information within the various company systems is identified. It is often is a good idea to build environmental information collection into routine business functions as this can save both time and money (see Case Study 6.4). For example, a company could register raw material weight from supplier invoices at the same time as it registers raw material costs.

Below are listed the various company systems where environmentally-related information may be held and the relevant information that they may contain.

I. *Accounting system*

A. Supplier invoices and accounts;
B. Disposal contractor invoices and own depot costs;
C. Investment planning records;
D. Current accounts;
E. Financial reports
F. Payment to contractors and current accounts; and,
G. Training costs, consultant costs and wages of environmental personnel.

II. *Production system*

A. Raw material use and characteristics
B. product recipes;
C. Energy use;
D. Water use;
E. Packaging use and chararacteristics
F. Waste generation;
G. Production records;
H. maintenance records.

III. *Purchasing and sales systems*:

A. Warehouse records;
B. Total weight of products shipped;
C. Weight of packaging used;
D. Raw material and packaging characteristics

IV. *Human resource system:*

A. Employee database; and
B. Job descriptions.

Case study 6.4 shows how Coloplast A/S has integrated the collection of environmental data into its other business systems.

Case Study 6.4 - Coloplast A/S

The Danish medical supply manufacturer Coloplast A/S has integrated the collection of environmental information in its corporate business planning and control systems. The company has several production facilities in Denmark that exchange raw materials or semi-finished products. An input/output registration computer model has been developed which can register raw materials from suppliers, physical exchanges between Coloplast's production facilities, products being sent to customers and wastes being generated. The input/output model is the at the core of the companies environmental registration system. The system receives inputs from the accounting system, the warehouse system and the production planning system.

In developing the system itself the company created a special bill of raw materials for the saleable products. By comparing these to the weight of raw materials calculated from the conventional bill of materials, the company can determine the difference between amount of raw materials in products sold and raw materials bought. Furthermore, all waste skips are weighted before being removed and typed into the system. One obvious advantage of having a system of this kind is that a reasonably accurate ecobalance (see Chapter 7) of the company can be constructed within a short period of time and without requiring extensive preparations. Furthermore, measures of production efficiency are easy to produce. Another advantage is that the environmental auditing process becomes easier and more effective using the data from the system. Coloplast A/S uses the information from the system in making environmental management decisions, monitoring priority areas and in the publication of an environmental performance report.

Further Information

For further advice on management indicators see:

Reporting on Environmental Performance (The Canadian Institute of Chartered Accountants (1995**,** CICA)

For further advice on financial indicators see:

An Introduction to Environmental Accounting as a Business Tool: Key Concepts and Terms (The United States Environmental Protection Agency, 1995, Office of Pollution Prevention and Toxics)

Green Ledgers: Case Studies of Corporate Environmental Accounting (Ditz, D et al, 1995, World Resource Institute)

7. Ecobalances

7.1. What is an ecobalance?

A company ***ecobalance*** records the various raw materials, energy, resources, products and wastes entering, held within and leaving a company over a specified period of time i.e. it provides a record of a company's physical inputs, stock and outputs.

Note: Other terms used to describe the ecobalance process include *mass balance* and *input/output analysis*.

Seven major categories of inputs and the corresponding stocks and outputs are shown in Table 7.1.

Inputs	Stock	Output
Land	Land	Land and contaminated land
Buildings	Buildings	Buildings
Plant and equipment	Plant and equipment	Plant and equipment
Product related materials	Product related materials	Products and solid waste
Energy		Energy emissions
Water		Waste water
Air		Air emissions.

Table 7.1 - The major categories of the ecobalance

Ecobalances can also be compiled for processes and products. The methodology for all three ecobalances is the same (i.e. an inventory of physical throughputs) - it is just the boundaries that differ

- A process balance is an inventory of the materials and energy inputs to a particular process, and the product and waste outputs of that process during a specified time period.
- A product balance is an inventory of the materials and energy inputs used to produce a particular product and the waste resulting from its production during a specified (see Case Study 6.2 Danish Steel)

The three types of ecobalance are shown in Figure 7.1. This chapter will concentrate on the company ecobalance.

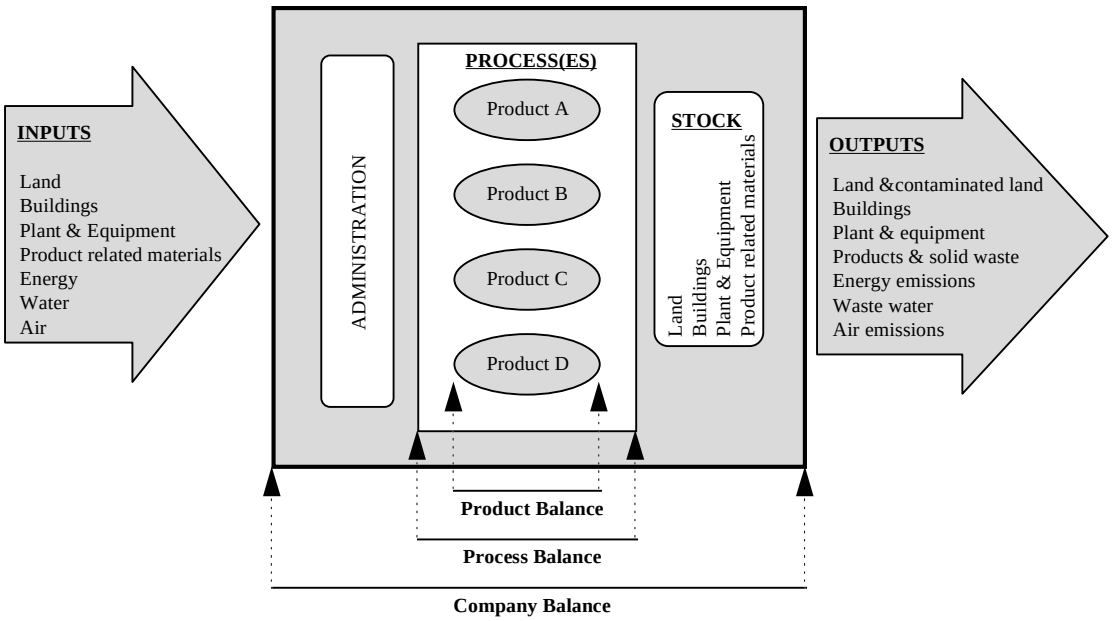

Figure 1: Types of Ecobalances

Figure 7.1 Types of Ecobalances

7.2. Why use an ecobalance?

An ecobalance is a useful business tool as it provides a clear picture of the flow of materials and energy within a firm and therefore enables opportunities for improving the efficiency of operations to be seen.

An ecobalance is also very useful from an environmental point of view. In order to effectively manage its environmental affairs, a firm needs to identify its environmental aspects i.e. those of its inputs and outputs that have or can have an impact on the environment. Once it has done this it can identify which of its aspects have a significant environmental impact. A company is then in a position to look at reducing these environmental impacts in ways that most benefit its business position - i.e. improving its environmental performance and its business performance.

In order to identify *all* of its environmental aspects - a firm needs to evaluate *all* of its inputs and outputs. An ecobalance is tool that allows a firm to do this as it provides a *complete* account of a firm's inputs and outputs.

In order to develop an environmental management system that meets the requirements of ISO 14001/EMAS a firm must carry out an environmental review in order to identify its environmental aspects (see Box 4.1). An ecobalance is an ideal tool to use within the review as it enables a firm to identify *all* its environmental aspects.

7.3. How to do it?

This section begins by looking in detail at the categories of inputs, stock and outputs listed in Table 7.1. It then goes on to present two case studies of companies that use the ecobalance tool. Finally it sets out an ecobalance starter pack that lists the areas that need to be covered in order to perform an effective ecobalance.

It is important to note that an ecobalance can be done in stages. It is not necessary to collect the information for all the 7 categories listed in Table 7.1 at one time. A firm can start the process by collecting information for those categories which it feels to be most important and when time and resources become available it can collect data for the remaining categories

Input, stock and output categories

Tables 7.2, 7.3, and 7.4 look in more detail at the various input, stock and output categories listed in Table 7.1. **Note**: Within the ecobalance, data should be expressed in the same units (kg for materials and kWh for energy where possible) in order to make the different material and energy streams comparable.

INPUT	Coverage	Purpose
Land area bought or otherwise acquired by the company.	Sealed land, such as car parks; green land, including grassed areas and natural habitats; and, built-over areas, which is further subdivided in the next section.	To determine the quantity and quality of land used by the company.
Usable buildings bought or otherwise acquired.	Production, including for example hotel rooms and other activities of the service industry, distribution and storage, administration and others.	To determine the types of use of buildings to understand the nature of environmental risk.
Major pieces of plant and equipment bought or otherwise acquired by the company .	Production machines; office and communication machines, such as photocopiers and computers; vehicles; and, industrial facilities, such as technical equipment.	To determine the amount and type of resources used by the company.
Product and/or service related goods.	Includes materials that directly go into the product or service and is split into: raw materials; semi-finished and finished goods; auxiliary goods and ancillary goods.	To determine the amount and type of resources used by the company.
The consumption of energy.	Including gas, electricity, oil and other fuels.	To determine the amount and type of natural resources used by the company.

The consumption of water.	From various sources: potable, i.e. treated water from an external source; rain water; and, and raw water, i.e. from rivers.	To determine the amount and type of natural resources used by the company.
The consumption of air.	An estimate of air used for production and energy production.	Can realistically only be an estimate but is necessary to balance the inputs and output of the firm.

Table 7.2: Inputs - coverage and purpose.

STOCK	Coverage	Purpose
Land area which is owned, leased, or otherwise occupied by the company.	Sealed land, such as car parks; green land, including grassed areas and natural habitats; and, built-over areas, which is further subdivided in the next section.	To determine the quantity and quality of land used by the company.
Usable buildings which are owned, leased, or otherwise occupied.	Production, including for example hotel rooms and other activities of the service industry, distribution and storage, administration and others.	To determine the types of use of buildings to understand the nature of environmental risk.
Major pieces of plant and equipment owned, leased, or otherwise used by the company.	Production machines; office and communication machines, such as photocopiers and computers; vehicles, including type, number, distances driven, fuel consumption and oil consumption; and, industrial facilities, such as technical equipment.	To determine the amount and type of resources used by the company.
Product and/or service related materials	See Table 7.2	See Table 7.2

Table 7.3: Stock - coverage and purpose

OUTPUTS	Coverage	Purpose
Land area sold or otherwise divested by the company.	Sealed land, such as car parks; green land, including grassed areas and natural habitats; and, built-over areas, which is further subdivided in the next section.	To determine the quantity and quality of land used by the company.
Usable buildings bought or otherwise divested.	Production, including for example hotel rooms and other activities of the service industry, distribution and storage, administration and others.	To determine the types of use of buildings to understand the nature of environmental risk.
Major pieces of plant and equipment bought or divested by the company.	Production machines; office and communication machines, such as photocopiers and computers; vehicles; and, industrial facilities, such as technical equipment.	To determine the amount and type of resources used by the company
Products or services the company produces.	Includes by-products, i.e. goods or services that are not categorised as waste; and, packaging, including product and transporting.	To determine the efficiency of production from inputted materials and products to output products.
Waste the company generates and the destination of the waste.	i.e. treatment, landfill, incineration and others in the categories: hazardous waste; waste which is recycled, internal and external; and, residual waste.	To determine the type, quantity and final destination of waste to land.
Energy emissions.	In the form of heat and others which have not entered the product; and, noise generated by activities of the company.	To determine the level of disturbance through noise and conversion of fuel to energy.
Waste water including the categories.	Quantity; destination, i.e. river, sewerage system, landfill and others; and concentration of pollutants contained in the waste water.	Use, quality and destination of water disposal.
Air emissions from the company.	Quantity of emissions; and, the concentrations of pollutants in the air emissions.	Conversion of fuel into energy and emissions direct to the atmosphere.

Table 7.4: Outputs - coverage and purpose

Case study 7.1: Kunert

Kunert AG is Europe's largest manufacturer of socks and nylon stockings. With approximately 4,000 employees, the company had a consolidated turnover of 559 million DM in 1994. The group produces at eleven sites in Germany, Southern Europe and Northern Africa.

The first of Kunert AG's environmental principles is:

"*The principle corporate goal is still to generate earnings. The economical use of resources corresponds to economic and environmental principles. In many cases, measures to protect the environment lead to cost savings and improve the earning power of the company*".

The ecobalance puts this into practice, as Kunert AG states in its 1994/5 environmental report:

"*Following the input-output system is one way of ensuring that all relevant environmental aspects are dealt with in full as this system covers all flows of materials and energy that are taken from the environment and put back into the environment.*"

Categories	INPUTS	STOCK		OUTPUTS	Categories
1. Land (m^2)	**12,931**	**649,960**		**9,602**	**1. Land (m^2)**
1.1. Sealed	636	65,750		2,692	1.1. Sealed
1.2. Green	938	448,386		340	1.2. Green
1.3. Built-over	11,357	132,824		6,570	1.3. Built-over
2. Buildings (m^2)	**17,447**	**185,369**		**17,923**	**2. Buildings (m^2)**
2.1. Production	1,210	72,107		9,347	2.1. Production
2.2. Distribution & storage	16,059	96,667		7,566	2.2. Distribution & storage
2.3. Administration	178	16,415		1,010	2.3. Administration
3. Plant & Equipment (pieces)	**1,436**	**16,715**		**1,263**	**3. Plant & Equipment (pieces)**
3.1. Production machines	530	5,943		973	3.1. Production machines
3.2. Office equipment	583	7,436		167	3.2. Office equipment
3.3. Office & comm. machines	277	2,972		111	3.3. Office & comm. machines
3.4. Vehicle fleet	25	182		7	3.4. Vehicle fleet
3.5. Technical facilities	21	182		5	3.5. Technical facilities
4. Circulating goods (kg)	**11,055,912**	**-**	**-**	**8,492,704**	**4. Products (kg)**
4.1. Raw materials	3,558,124	697,183	2,786,664	5,199,188	4.1. Hosiery
4.2. Semi & finished goods	2,082,292	-	-	194,911	4.2. Outer wear
4.3. Auxiliary materials	3,936,325	-	-	897,598	4.3. Transport packaging
4.4. Ancillary materials	1,479,171	-	-	2,201,007	4.4. Product packaging
5. Energy (kWh)	**118,986,31**	**N/A**	**36,398**	**2,357,988**	**5. Waste (kg)**
5.1. Gas	**3**	N/A	3,910	62,883	5.1. Hazardous waste
5.2. Electricity	16,570,184	N/A	25,236	1,816,553	5.2. Recyclables
5.3. Fuel oil	33,123,331	497,616	6,052	349,652	5.3. Residual waste
5.4. District heating	47,262,590	N/A	1,200	128,920	5.4. Building Rubble
5.5. Fuel	5,586,418	N/A	N/A	118,986,313	5.6. Waste heat
	16,443,790				
6. Water (m^3)	**428,770**	**N/A**	**N/A**	**339,277**	**6. Waste water (m^3)**
6.1. Tap water	281,275	N/A			
6.2. Raw water	147,495	N/A			
7. Air (m^3)	-	**N/A**	**-**	**-**	**7. Air emissions**
			N/A	100,548	7.1. NO_x (kg)
			N/A	170,132	7.2. SO_2 (kg)

			N/A N/A	36,109,594 96,895,400	7.3. CO_2 (kg) 7.4. Steam (kg)

Case Study 7.2 Möbelwerkstätte Schmidt[i]

Möbelwerkstätte Schmidt is a small-scale German carpentry in with 10 employees and an annual turnover of about £400,000. The impact of its products both on both the environment and on human health has long been a prime concern of the company. The company has sought to improve its environmental performance (and at the same time generate new market opportunities) by producing furniture from solid wood (rather than chipboard) and using natural oils and waxes to treat its products.

In 1995, the company conducted a full input-output-type mass and energy balance in an effort to further improve its environmental performance. As a result, the company improved its control of various materials and substances used in its processes. The data generated also enabled the company to develop meaningful environmental performance indicators to help it measure its progress in achieving its environmental targets - such as the reduction of solvents, other hazardous substances and various process wastes.

The company published the results of its work in a 12-page environmental report, which was distributed to customers and is publicly available. In addition, it made the report available on the Internet. State television broadcast a report about the company's environmental activities and it has received coverage in many regional newspapers. In 1997 the company became registered under EMAS, updating its environmental report so as to meet the requirement within EMAS for an environmental statement (see Chapter 4). As a result of its environmental management activities, the company has significantly reduced its environmental impact, reduced its costs through waste avoidance and gained a new customers.

[i] Case study prepared by Rainer Rauberger, Institut für Management and Umwelt, Ausburg, Germany

Starter Pack

This starter pack lists those area within each input, stock and output category where data needs to be collected in order to perform an ecobalance. Remember that not all the data has to be collected at once. If you want to make a start on an ecobalance concentrate on those categories that are most important to your company and deal with the others at a later date.

DESCRIPTION	Total Annual INPUTS	Total Annual STOCK	Total Annual OUTPUT
1. Total Land (m^2)			
1.1. Total Sealed Land			
1.1.1. Roads			
1.1.2. Car parks			
1.1.3. Built-over			
1.1.4. Others			
1.2. Total Green & Water Areas			
1.2.1. Gardens			
1.2.2. Fields			
1.2.3. Woodland habitats			
1.2.4. Water habitats			
1.2.5. Water ways			
1.2.6. Others			
1.3. Total Buildings (usable surface)			
1.3.1. Production			
1.3.2. Distribution & storage			
1.3.3. Administration			
1.3.4. Other			
1.4. Total Contaminated land			
1.4.1. Chemical works			
1.4.2. Metal processing industries			
1.4.3. Industries making or using wood preservatives			
1.4.4. Munitions production and existing sites			
1.4.5. Nuclear installations			
1.4.6. Paper and printing works			
1.4.7. Railway land			
1.4.8. Tanneries			
1.4.9. Waste disposal sites			
1.4.10. Others			
1.5. Total Other			
1.5.1. Quarries			
1.5.2. Landfills			
1.5.3. Others			

DESCRIPTION	Total Annual INPUTS	Total Annual STOCK	Total Annual OUTPUT
2. Total Plant & Equipment (pieces/£value)			
2.1. Total Production Machines			
2.1.1. Itemised List of Production Machines:			
2.2. Total Office & Communication Machines & Equipment			
2.2.1. Itemised List of Office & Communication Machines & Equipment:			
2.3. Total Vehicles owned by the company:			
2.3.1. Site vehicles (forklifts etc.)			
2.3.2. Motorcycles			
2.3.3. Cars			
2.3.4. Vans & Minibuses			
2.3.5. Heavy Goods Vehicles			
2.3.6. Trains			
2.3.7. Ships			
2.3.8. Aeroplanes			
2.3.9. Others			
	Total Annual Distance	**Total Annual Fuel Consumption**	**Total Annual Oil Consumption**
2.4. Total Vehicles owned & used for company business:			
2.3.1. Site vehicles (forklifts etc.)			
2.3.2. Motorcycles			
2.3.3. Cars			
2.3.4. Vans & Minibuses			
2.3.5. Heavy Goods Vehicles			
2.3.6. Trains			
2.3.7. Ships			
2.3.8. Aeroplanes			
2.3.9. Others			
	Total Annual INPUTS	**Total Annual STOCK**	**Total Annual OUTPUT**
2.5. Total Specialist Equipment			
2.5.1. Itemised List of Specialist Equipment:			

DESCRIPTION	Total Annual INPUTS	Total Annual STOCK	Total Annual OUTPUT
3. Total Product related goods (kg or £ or approx. % of total or specify other)			
3.1. Total Raw Materials			
3.1.1. Itemised List of Raw Materials:			
3.2. Total Semi- & finished goods (Bought into the company)			
3.2.1. Itemised List of Semi- & Finished Goods:			
3.3. Total Auxiliary Goods			
3.3.1. Itemised List of Auxiliary Goods:			
3.4. Total Ancillary Goods (Consumables)			
3.4.1. Itemised List of Ancillary Goods (Consumables):			
3.5. Total Products (Marketed)			
3.5.1. Itemised List of Products (Marketed):			
3.6. Total By-products			
3.6.1. Itemised List of By-products:			

DESCRIPTION	Total Annual INPUTS	Total Annual STOCK	Total Annual OUTPUT
3.7. Total Waste			
3.7.1. Total Hazardous Waste			
3.7.1.1. Solids			
3.7.1.2. Liquids			
3.7.1.3. Waste: surface treatment metals			
3.7.1.4. Waste: biocide products			
3.7.1.5. Waste oil			
3.7.1.6. Waste with PCBs			
3.7.1.7. Clinical and pharmaceutical waste			
3.7.1.8. Waste from photographic processes			
3.7.1.9. Organic solvents			
3.7.1.10. Paints and pigments			
3.7.1.11. Resins			
3.7.1.12. Batteries			
3.7.1.13. Electronic scrap metal			
3.7.1.14. Hazardous Waste - Others			
3.7.2. Hazardous Waste Disposal:			
3.7.2.1. Hazardous waste - treated			
3.7.2.2. Hazardous waste - recovered			
3.7.2.3. Hazardous waste - incinerated			
3.7.2.4. Hazardous waste - landfilled			
3.7.2.5. Hazardous waste - other disposal			
3.7.3. Total Residual Waste			
3.7.3.1. Paper/ paper board/ paper products			
3.7.3.2. Plastics			
3.7.3.3. Glass			
3..7.3.4. Metals			
3..7.3.5. Others			
3.7.4. Residual Waste Disposal			
3.7.4.1. Non-hazardous waste - mechanically sorted			
3.7.4.2. Non-hazardous waste - composted			
3.7.4.3. Non-hazardous waste - incinerated			
3.7.4.4. Non-hazardous waste - landfilled			
3.7.4.5. Non-hazardous waste - other disposal			
3.7.5. Total Recycled			
3.7.5.1. Paper			
3.7.5.2. Plastics			
3.7.5.3. Glass			
3.7.5.4. Metal			
3.7.5.5. Hazardous			
3.7.5.6. Composted			
3.7.5.7. Others			

DESCRIPTION	Total Annual INPUTS	Total Annual STOCK	Total Annual OUTPUT
4. Total Energy (kWh or specify other)			
4.1. Gas			
4.2. Electricity			
4.3. Oil			
4.4. Fuel			
4.5. Combined heat & power			
4.6. Others			
4.7. Noise & Vibrations (description of measurements and reports):			
5. Total Water (m3)			
5.1. Potable (drinking quality)			
5.2. Rain (collected)			
5.3. Raw (rivers, lakes & bore holes)			
5.4. Waste Water			
5.5. Biological Oxygen Demand (BOD)			
5.6. Chemical Oxygen Demand (COD)			
5.7. Suspended Solids			
5.8. Cadmium (Cd)			
5.9. Mercury (Hg)			
5.10. Other Heavy Metals			
5.11. pH Range			
5.12. Temperature Range			
6. Total Air emissions (m3 or Kg or specify other)			
6.1. Ammonia (NH3)			
6.2. Carbon Monoxide (CO)			
6.3. Carbon Dioxide (CO2)			
6.4. Nitrogen oxide (NO)			
6.5. Nitrogen Dioxide (NO2)			
6.6. Sulphur Dioxide (SO2)			
6.7. Chlorofluorocarbons (CFCs)			
6.8. Halons			
6.9. Dust			
6.10. Volatile Organic Compounds (VOCs)			
6.11. Others			
6.12. Odours (description of measurements and reports):			

8. Life-Cycle Assessment

8.1. What is life-cycle assessment (LCA)?

Life-cycle assessment (LCA) is a systematic framework for carrying out an assessment of all of the environmental impacts associated with a product over its entire life-cycle.

Aim of LCA

The aim of LCA is to identify and quantify all of the environmental impacts associated with a product. LCA achieves this by taking a "*cradle to grave*" approach, considering all the impacts associated with a product throughout its lifetime or life-cycle - i.e. from raw material acquisition (the "*cradle*") through production, use and disposal (the "*grave*"). By doing so, LCA identifies those particular aspects of a product which have the largest environmental impact. Producers can then focus their efforts on these aspects in order to reduce/minimise the product's environmental impact.

For more information see also the "Life cycle assessment - a guide to approaches, experiences and information sources" (EEA Environmental Issue Series no 6)

Figure 8.1 illustrates the life-cycle of a light bulb.

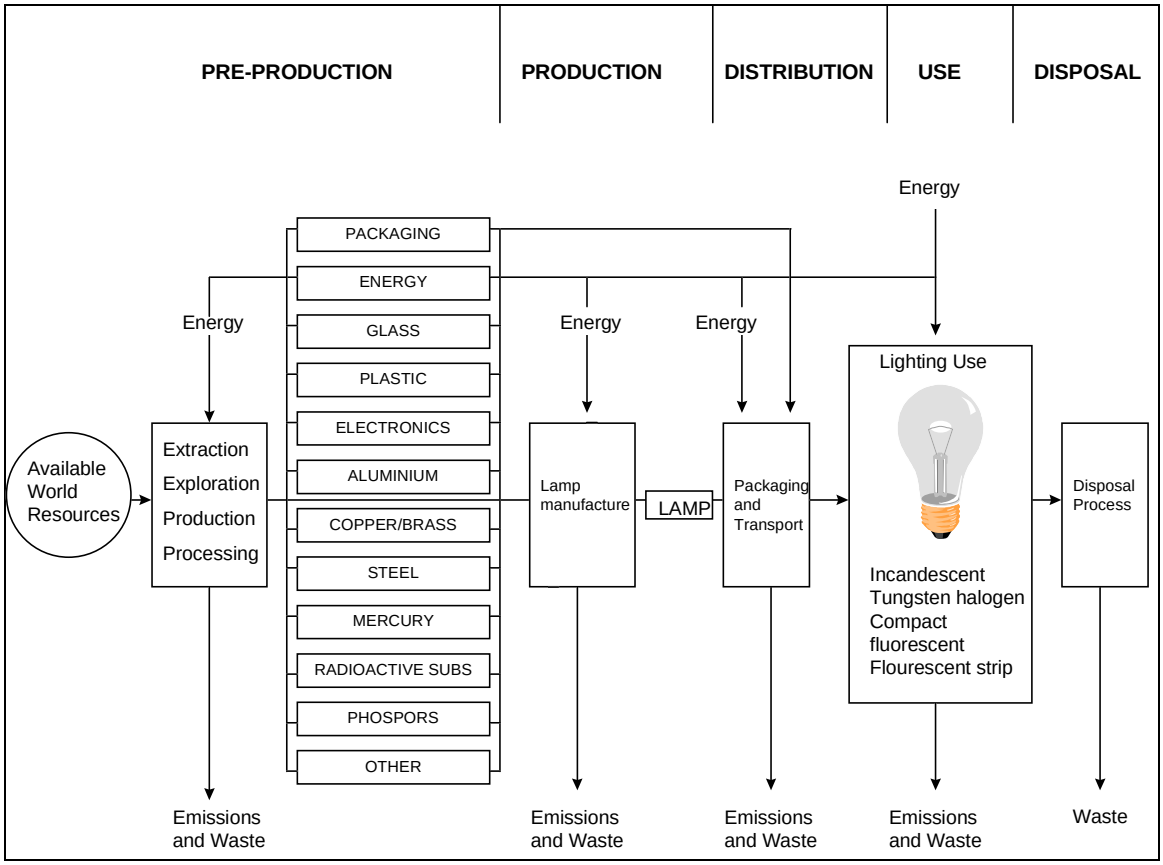

Figure 8.1 The Life Cycle of a Light Bulb[i]

The life cycle phases of the light bulb are:

Pre-production

- Obtaining the raw materials from which the various materials/components that make up a light bulb are manufactured
- The manufacture of the components
- Their transport to the manufacturing site

Production

Further processing of materials and the assembly of components to produce the finished light bulb.

Distribution

The packaging of the light bulbs and their transport from the place of manufacture to retail outlets

Ulilization

The use of the lightbulb in domestic or commercial settings to provide light

Disposal

The throwing away of the lightbulb at the end of its life

[i] Reproduced with permission of the UK Ecolabelling board.

In an LCA of the light bulb, the impacts associated with the inputs and outputs of the processes in its various life cycle phases are considered. These inputs and outputs are shown in Figure 8.1. In the case of the light bulb, LCAs have shown that 90% of its environmental impact occurs during use.

LCA standardization

The International Organisation for Standardization (ISO) is currently developing a series of standards for LCA. ISO 14040 (LCA principles and framework) sets out guiding principles for LCA and ISO 14041-43 focus on the various stages of the LCA process . For ISO's definition of LCA see Box 8.1.

Box 8.1 ISO Definition of LCA

ISO 14040 defines LCA as a technique for assessing the environmental aspects and potential impacts associated with a product, by:

- compiling an inventory of relevant inputs and outputs of a system*;
- evaluating the potential environmental impacts associated with those inputs and outputs; and,
- interpreting the results of the inventory and impact phases in relation to the objectives of the study.

* system

But isn't LCA too expensive and time-consuming for SMEs?

A full and comprehensive LCA of all of the impacts associated with a product from its cradle to its grave can be expensive and time consuming. However by streamlining the LCA process it is possible to reduce the cost of an LCA and the time spent doing it. A streamlined LCA can be carried out by focusing only on particular stages of the life-cycle, and/or on selected impacts. Box 8.6 has more details on ways to streamline LCAs. And in order to save time, LCA models or databases can be used to supply information on life-cycle impacts. However, some of these may be expensive to use. (For further information on LCA models see subsection 8.3.2 and Box 8.2.). And of course there may be grants available that contribute towards the cost of having an LCA carried out (see Case Study 8.4). Note that all the case studies in this chapter involve SMEs who have found LCA worth carrying out

Even if you don't carry out a formal LCA, it can be useful to incorporate a life cycle approach into your thinking i.e. to consider both the upstream and downstream effects of your firm's activities. For instance you may be able to change your supply of raw materials so as to lessen the environmental impacts caused upstream whilst at the same time saving money (see Case Study 2.6).

Links with other environmental management tools

- *Environmental management systems (EMS)*
  The life-cycle approach outlined above can be used within an EMS (see Chapter 4). An aim of your environmental policy may be to reduce the environmental impacts associated with your products. LCA provides a means of achieving this as it enables an assessment to be made of the

impacts associated with your product across its entire life-cycle -i.e. within your firm and both upstream and downstream.

- *Environmental labelling*
  All the national environmental labelling schemes operating within the EU use LCA as the basis for setting the criteria which products must meet if they are to be eligible for an environmental label (see Chapter 9).

8.2. Why do it?

There are a number of reasons for carrying out an LCA. These can be summarised as:

1. Financial benefits
2. Design
3. Marketing

1. Financial benefits
LCA examines a product's life-cycle and identifies where the main environmental impacts arise. Often these environmental impacts can be reduced by increasing the efficiency with which material and energy inputs are used. Increasing the efficiency of resource use will reduce the quantity of inputs used and waste produced, thereby reducing cost.

2. Design
LCA can be used to aid decision making over product or process design or redesign. LCA can be used to compare the environmental impacts of different design options and assess whether any have potentially significant environmental advantages or disadvantages.

LCA enables the aspects of the product which generate the most significant environmental impacts to be identified, allowing designers and manufacturers to focus on these areas so as to obtain environmental improvements. It is often through changing the design of a product that the most significant environmental benefits can be achieved. For instance, should product use be the major area of environmental impact, as is the case with washing machines, then efforts to reduce the impact of the good should centre on redesigning it so that the environmental impact during use is reduced (and also providing the consumer with accurate advice on how best to use the product).

Case study 8.1 Polytops Ges.mbH[ii]

Polytops Ges.mbH., a small enterprise in Hard am Bodensee, Austria with 15 employees, produces high density polyethylene (HDPE) closures for carbonated beverages bottles, both glass and PET. As a part of setting up an ISO 14001 environment management-system, a LCA of these closures was carried out, looking at all parts of the product lifecyle - from raw materials production through to product disposal.

results of the LCA showed that the main environmental impacts associated with the closure resulted from raw-materials production, transport, and energy use in manufacturing. By developing a closure with lower material intensity, all three impacts were reduced simultaneously. This new closure weighs about 12 % less than the old design, one consequence being that the CO_2 emissions associated with one closure over its lifetime are reduced by nearly one gramme. This redesign not only reduced the environmental impact of the closure but reduced the company's production costs. The lower production costs resulted mainly from the reduced quantity of raw material used in each closure, but also from a reduction in energy usage due to the shorter running time of the injection process needed to produce the new closure. Thus, Polytop's closures can be sold more cheaply thereby giving the company a competitive advantage in the marketplace.

3. Marketing

LCAs have often been used by large companies as a marketing tool. Producers advertise the "environmental friendliness" of their product as a means of increasing sales. LCA can be used as the basis for advertising claims that one product has less of an environmental impact than other similar products

However, this use of LCA has, on occasion, been discredited. The most renowned case was a dispute over the relative virtues of disposal and re-usable nappies. Proctor and Gamble's claim that their was no difference in environmental performance between disposable nappies (which it manufactures) and reusable nappies was supported by their use of a particular LCA which had reached this conclusion. This claim was subsequently dropped after the Women's Environmental Network, an environmental NGO, showed that a number of studies across Europe and the US concluded that re-usable nappies were less environmentally damaging than disposables. It is important that if using LCA for marketing you ensure that any assumptions made are transparent and defensible.

Customer LCAs

Many large companies are now concerned not only with their own environmental performance but with the performance of the suppliers and vendors within their supply chain. In other words they are concerned with the environmental performance of all the firms involved throughout the life-cycle of their products. By encouraging firms throughout the life cycle to improve their peformance (or in some cases insisting that they do so) large companies are able to reduce the life cylce impacts of their products (see Case Study 3.1).

This means that as a supplier to a large firm you may be asked to demonstrate sound environmental management and/or to provide information to your customers that will enable them to undertake an LCA of their products. The ability to demonstrate good environmental management or provide relevant LCA information will undoubtedly put you in a good position to continue doing business with your customers whilst a failure to do so could result in your customers giving their business to another supplier.

[ii] Case study prepared by Gabriel Caduff of the Swiss Federal Institute of Technology, Zurich, Switzerland

8.3. How to do an LCA

It is easiest to break the LCA down into a number of methodological stages (Figure 8.3). The 3 main stages are:

1. Goal and scope definition
2. Inventory
3. Evaluation

8.3.1. Goal and scope definition

The first stage of the LCA process is to define the aims, geographical scope and extent of your LCA. This is often referred to as the ***goal and scope definition*** stage.

Goal setting
At this stage the stakeholders that you wish to involve should be identified and brought together to plan the LCA study and help establish the goals. All LCAs will require a number of assumptions and decisions to be made which can influence the results of the study. It is important that the goals are clearly defined at the start, so that any future decisions are based on these goals.

The goals and scope of the study can be determined by considering of a number of questions:

- Is the study going to deal with a completely new product or the redesign of an existing product?
- How is the study going to be disseminated? Is it going to be published/made available to stakeholders?
- Are there a range of alternative designs and processes to compare or does the study just involve an assessment of one well defined line of production?
- Do you need to assess the product in order to make a comparison with the products of your competitors?
- Are there certain quality standards and fitness for use criteria which limit the design alternatives?
- What is the ultimate function of the product and can this function be met in a completely different way which should be considered?
- What are the main environmental issues that are of concern to your firm? Are you concerned with the local, global and regional impacts of the product, or are just local impacts of importance?

Answers to these questions will help to determine the depth and breadth of your LCA study.

It is especially important to decide at an early stage whether the LCA is going to be comparative - that is comparing the impacts of two or more products that achieve the same end, or is it going to be of just one product. The advantages of carrying out a comparative LCA is that it provides a baseline

against which to compare your own product. Many of the LCAs that have been most publicised have been comparative. For example, LCAs of disposal v reusable nappies and paper v plastic cups. For an example of a comparative LCA used by an SME see Case Study 8.2.

An LCA of just your product should be used if your reason for doing the LCA is just to identify the stages of the life-cycle at which the most significant environmental impact occurs.

Case study 8.2 The Gully Strainer[iii]

In the Netherlands, there are some 5 million street drains, which, according the three men who invented the "Gully Strainer", are not very effective. In their view, the drains too easily become blocked with leaves and litter and therefore too much maintenance is required to prevent the streets from flooding. The Gully Strainer is a perforated rectangular plastic plate that is placed against the wall of the drain and prevents the refuse that accumulates there from blocking the pipe that carries rain water from the drain to the main sewer. Without using the Strainer, drains become blocked when one third full of refuse, as at this point the accumulated refuse covers the pipe to the main sewer. However when the Strainer is used, rain water can flow to the main sewer no matter how much refuse accumulates in the drain and so it only has to be cleared when it is full. Using the Strainer substantially reduces costs for the user as drains only have to be cleared one third as often.

A Dutch patent was obtained in April 1997 and 14,000 strainers have already been sold to the municipality of Beverwijk. The inventors are working hard to set up a company to market the strainer across Europe. Whilst the economic benefits of the the strainer were quite clear, the inventors were keen to establish whether the Strainer had any environmental benefits? They were aware that such benefits would be a good selling point for the Strainer, as most potential clients are local governments who are increasingly concerned about the environmental performance of the products they purchase. In order to determine whether there were any environmental benefits to using the strainer, the inventors, with the support of the local Innovation Centre, had and LCA of their product carried out.

The LCA compared two scenarios in the municipality of Beverwijk:

- The present situation, where drains are clean once a year
- A situation where, by using the Gully Strainer, the drains are cleaned once every three years. The environmental impacts resulting from the production and disposal of the Strainer were inlcuded in this scenario.

In order to clean Beverwijk's 14,000 street drains once a year, a special truck is used, which consumes 10,000 litres of diesel. By reducing the cleaning frequency to once every 3 years, diesel use is reduced by a factor of three. The strainer will be manufactured from polyethylene using an injection moulding technique. Installation of the strainer can be done after a drain has been cleaned so no extra transport is required. Therefore no extra environmental impact results. It is assumed that the strainer will have a lifespan on 25 years and will be disposed of by incineration.

The results of the LCA showed that the reduced environmental impact from cleaning the drains every three years massively outweighed the increased environmental impact from the manufacture and disposal of the strainers. By using the strainer and reducing the cleaing frequency to once every three years, the environmental impact

[iii] Case study prepared by Renilda Spriensma of PRé Consultants b.v., Amersfoort, Netherlands

is reduced by 60% (see Figure 8.2). Even if drain cleaning takes place every two years, the environmental impact is still reduced by 57%.

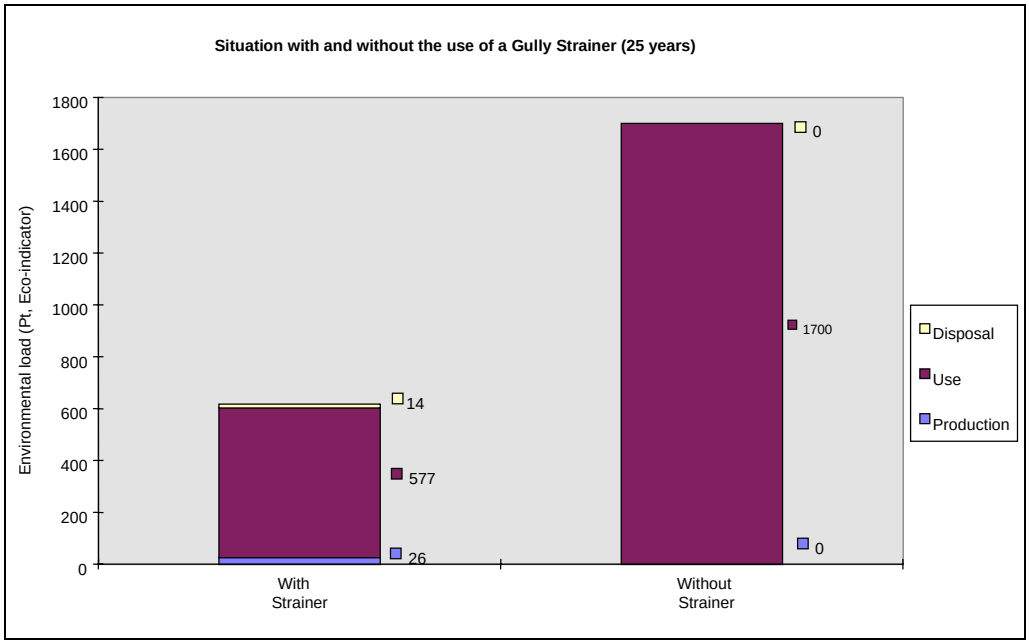

Figure 8.2 The total environmental load (expressed as Eco-indicator points) of the two different situations

The LCA was conducted assuming that the strainer was manufactured from virgin materials. However, if the strainer were manufacured using recyled polyethylene rather than virgin materials or using foamed thermoplastics, the environmental impact resulting from the manufacturing phase would be reduced. The Gully Strainer company, which is still in formation intends to further optimize the design of the product, by reducing the amount of material used in the product and by using more recycled materials. Not only will this improve the environmental performance of the strainer, it will save the company money.

Product definition

You will need to define exactly what your product is, and the quantity which you wish to use as the baseline. This baseline is referred to as the *functional unit*. As losses occur over most systems, it is important to identify the stage of the life-cycle at which the functional unit is relevant. All of the environmental impacts associated with the life-cycle will then be expressed in terms of this functional unit. For example, in the case of an LCA of paper, you might choose as your functional unit 1 kg of paper at the retail stage. To deliver 1 kg of paper to a retailer, it may be necessary to produce 1.1 kgs of paper at the mill stage. Thus, the environmental impacts associated with producing 1.1 kg of paper will be calculated.

If you are carrying out a comparative LCA, the functional unit for both LCAs should be the same, such that you can carry out a direct comparison. Taking the case of incinerating v recycling paper, the functional unit for both would be 1 kg of paper at the retailers.

Boundary setting

One of the main parts of this stage of an LCA is to define the life-cycle of the product in question. In theory the life-cycle should include all of the stages

upstream and downstream of a product. However, the potential scope of an LCA would be enormous if we were to consider absolutely every environmental impact of the product and all the knock-on effects. If we consider paper production for example, should we consider the type of saw used for tree felling? An even deeper assessment might consider where the petrol comes from to drive a chain saw, where the nuts and bolts came from for the saw and what emissions are generated during its use. ***A cut-off point, or boundary, has to be drawn***.

The defined boundaries of the system for the LCA will depend on:

- aims of the study;
- available resources;
- extent of significant impacts; and
- ease of data availability.

Any LCA should include all the stages that are likely to have a significant environmental impact. If it does not, it is likely to be criticized and you will therefore lose many of the advantages of carrying out the study in the first place. However, to minimise the time and expense involved most SMEs will want to restrict the life-cycle so that those stages where significant impacts do not occur are excluded from the study (see Box 8.6).

Geographical scope

Many studies will need to consider geographical scope at this initial stage. Is the LCA to be specific to one location, with well-defined boundaries? For example is the product manufactured in a particular factory to be considered, using specific data on the suppliers and retailers. Or, is a more generic approach to be taken, looking at the product produced in an "average" factory in a particular country or region. The latter approach is likely to be required if a comparative LCA is being carried out, as a specific location is not likely to be available for alternative products.

Time horizon

The time horizon is an important issue if the product being assessed is expected to have a long life or if the particular design under study is expected to have significant longevity. It may be the case that, in the future , technologies will be developed that allow the product to be constructed so that its life cycle impact is reduced e.g. using some new component that allows the product to operate more energy-efficiently during its use phase. For such products and designs it may be useful to make some sort of estimate regarding possible developments in technology. However such estimation is not always easy and many LCAs are based on existing data, purely for simplicity.

Allocation

Many products life-cycles will be interlinked with other product life-cycles. For example, the life-cycle of electricity generation from gas would include the exploitation of gas from gas wells. Many gas wells also produce oil and this oil production will fall into the life-cycle of electricity generation from oil. In such situations decisions need to be made concerning the proportion of damage which should be allocated to the life-cycle under consideration. Should all of the environmental impacts from the well be associated with gas production, or only a proportion of them, as the well also produces oil?

Often the impacts will be divided based on the end use of the linked systems. For example, if the gas produces half as much electricity as the oil from that well, then the impacts associated with the gas life-cycle will be a third of those of the well. Different LCA studies have used different approaches to allocation. The approach used should be agreed at the outset of the study, based on the aims and remit of the study.

Case Study 8.3 Fetze Tigchlaar's stove[iv]

Approximately 10 years ago, Fetze Tigchlaar started building masonary stoves part time. Steadily his business grew and now, supported by his wife and one part-time employee, he produces 25 stoves per year.

The masonary stove is a special type of wood buring stove built from stone. The stone absorbs most of the heat produced from burning the wood, gradually emitting it into the room, making it particularly suitable for room heating. The stove's design in based on that of a Finnish fireplace which, with its use of secondary combustion, gives a high combustion efficiency and low emissions. Tichelaar's latest model is a modular stove made from fireproof concrete, which comes in a number of different sizes. As well as enabling faster, more standarized production, the new model has a longer life as it it can be adjusted in size, moved and partly re-used.

Environmental issues are important to a number of Tigchelaar's customers. For those customers using the stoves primarily for heating purposes, the fact that they use wood, a renewable source of energy rather than non-renewable fossil fuel is the main selling point. However most customers have central heating and use the stoves mainly to create an attractive atmosphere in their house. For these customers, the stove's benefits are that it has a high effiency and low emissions compared to other wood burning stoves. It is therefore important to Tigchlaar that his products have good environmental performance and hence he decided to have an LCA carried out on his latest model to establish its environmental performance.

The first part of the LCA looked at the production phase, comparing the environmental impacts resulting from the manufacture of the new concrete stove with those resulting from the manufacture of the old stone stove. The second part of the study looked at the use phase, comparing the impacts of the new stove whilst heating with those of an average wood-buring stove, an open fireplace and a central heating system.

Production phase

The use of fireproof concrete does not improve the enviornmental performance in the production phase (see Figure 8.3). The production of fireproof concrete requires a substantial amount of energy, and it is this which accounts for the majority of the material's environmental impact. The most effective way to reduce the stove's

[iv] Case study prepared by Renilda Spriensma of PRé Consultants b.v., Amersfoort, Netherlands

impact during this phase would be to use recycled concrete rather than make it up from virgin materials.

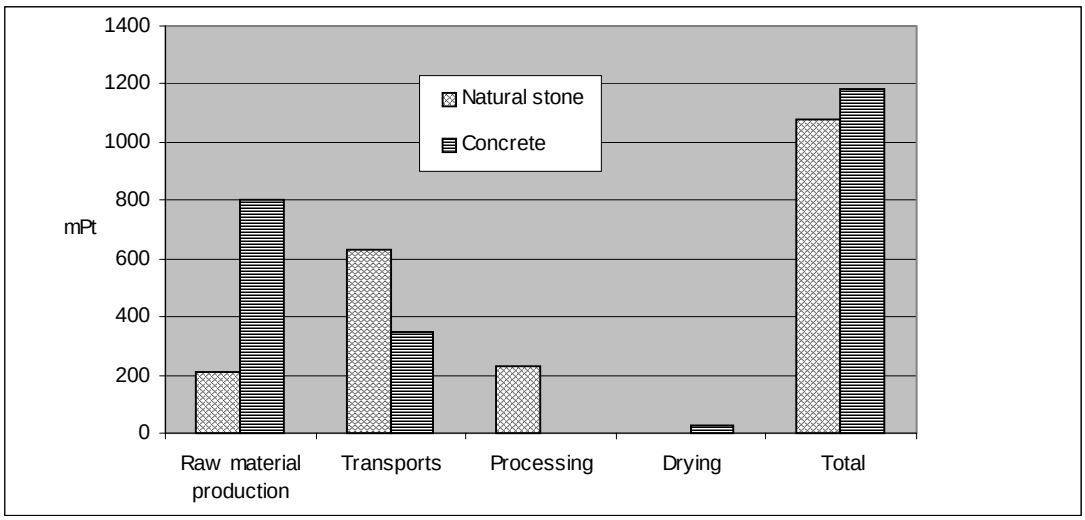

Figure 8.3 Environmental load of the production phase of two different heaters in Eco-indicator millipoints.

Use phase

In this part of the LCA the efficiency and emissions of the four heating systems were estimated. As definitive data on Fetze Tigchelaar's stove was not available at the time the LCA was conducted, provisional test data was used to produce best and worst case estimates (see Figure 8.4). The LCA revealed that the concrete stove has an environmental impact that is between 30% and 90% lower than that of an average wood burning stove or open fireplace. Further improvement of the combustion process could reduce the environmental impact of the stove to that of a central heating system - making it competitive in terms of environmental performance.

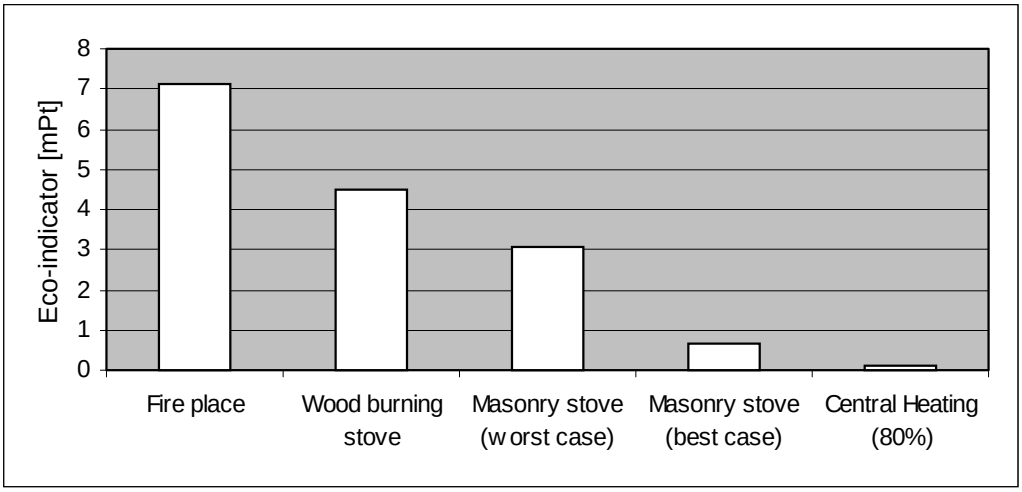

Figure 8.4 Environmental load of the use phase in Eco-indicator millipoints per unit heat produced.

Follow-up

As a result of the LCA study, Fetze Tigchelar started experimenting with using recycled concrete in his stoves, using new concrete only in the most crucial parts. His experiments suggest that, as well as reducing the environmental impact of the stove, the use of recycled concrete may well prove to be cheaper than using virgin

materials. Tigchelar has started new emissions analysis and is testing new ideas to improve the efficiency of the his concrete stove. The concrete stove is to be displayed in a permanent exibition of Sustainable Constructions, providing free publicity which should be good for business.

8.3.2. Inventory

Once the life-cycle under consideration has been defined, data is collected on the environmental burdens associated with each stage of the life-cycle. In LCA terminology, this is referred to as the "*inventory*". It is simply a matrix, spreadsheet or listing quantifying how much energy and raw materials are used, and how much solid, liquid and gaseous waste is generated, at each stage of a product's life.

In an ideal world, data specific to your company would be collated by asking suppliers and purchasers to quantify their inputs and outputs and collecting primary data from your own production process. However, this is often not possible. As a result, most LCAs obtain the information they require from LCA computer models. The models are based on databases of information relating to the environmental burdens at different stages of various product life-cycles. This means that full LCA information for a particular product can be obtained at the touch of a button. For example, you could enter 1 kg of cotton and the model would inform you of the environmental burdens associated with the life-cycle of that cotton.

The use of such models therefore makes LCA a quick and simple environment analysis tool. However, some of these models are expensive, often costing thousands of ECU.

Before using a model, it is important to check that the information it contains is relevant to your particular set of circumstance. For instance take the case of emissions arising from the transportation of goods. These will vary depending on whether petrol or diesel is used, whether the vehicle is a lorry or van and whether the majority of the journey is on slow moving urban roads, or along motorways. The better LCA models can provide you with data that is relevant to your particular transportation situation rather than providing a generic set of data for transportation.

It is possible with most LCA models to add data that has been collated specifically for your LCA to data from the database. Therefore you could collect some information on your own production process (energy use, material inputs and waste generation) and combine this with database information on the other stages up and downstream of your life-cycle.

Box 8.2 Things to look for in an LCA model

- ability to add your own data
- are the sources of data transparent?
- are these sources of information relevant to your LCA?
- can you specify the data to closely match your case? e.g. UK electricity mix, transport modes
- are the impact categories relevant to your goals?

- cost

Alternatively, a number of reports are available that have information on the life-cycle impacts of various products. Most of these are available at a relatively low cost (<£100). However, these reports do not contain information on as many products as the better databases and so may not contain information on your particular product.

Box 8.3 Using an External Consultant

Many SMEs will choose to use an external consultant to guide them through an LCA. External LCA consultants will be far more familiar with the methodology and aware of the potential pitfalls, hence able to guide you through the process quickly. Also, the data that is required may well mean that an LCA model will be required when carrying out an LCA. Many environmental consultants have access to LCA models. These models can be prohibitively expensive to buy, and an SME would only require to the model for a day or two. It is therefore advisable to either hire the model for a few days, or to use the model through a consultant, rather than purchasing it.

Using an external consultant can also aid the marketing side of the LCA. Results from an LCA that has been carried out entirely in-house may carry less weight than those that have used an external body, who may be viewed as more objective.

When using a consultant bear in mind the points made in Chapter 2 of this report.

Once the inputs to the system have been quantified, the outputs (emissions and waste) can be calculated. Typically, outputs may be listed under:

- solid waste
- liquid waste/water pollution
- emissions to air.

The result can be quite a forbidding list of data. In order to manage this data it is common to aggregate or classify it. This is usually done by impact category. Some examples of impact categories are shown in Box 8.4.

Box 8.4 Some typical environmental impact categories used in LCA

- global warming
- use of non-renewable resources
- loss of biodiversity
- human toxicity
- eco-toxicology
- radiation
- working conditions
- odour
- ozone depletion
- water pollution
- acidification
- eutrophication
- noise
- waste heat
- damage to landscape

Most LCA models will have a pre-defined set of impact categories. However, the range of impacts that are relevant will vary between studies. Some may wish to carry out a full assessment by considering the full range of impacts. In other cases it may be more relevant to just focus on few impact categories - those that are of most concern to your company. If you are collecting the data yourself, confining the study to impacts that are of most relevance to you could significantly reduce the amount of data collection required. However, if a model is being used, the information will already be available and reducing the number of impact categories may not significantly reduce the costs.

Part of the strength of LCA lies in this systematic collection and collation of quantitative data. It should establish the extent of the product's environmental impact and once this is done the scope for improvement to the product's environmental performance can be investigated. Going through the inventory process will focus attention on issues which can otherwise so easily be ignored. The process will confirm or challenge any assumptions and preconceptions about the product's impact over its life-cycle and should facilitate a greater understanding of the environmental impacts involved.

8.3.3. Evaluation

The third and final part of an LCA is the evaluation of the inventory data. The inventory will have generated a set of data on the environmental burdens associated with the life-cycle of your chosen product(s). The data relating to the various environmental burdens will probably be expressed in different units (e.g. data for energy use may be in joules, mass of physical waste in kilograms and air pollution in terms of parts per million). The whole inventory may be in the form of tables or graphs. An example inventory is shown in Table 8.1. This data can be quite overwhelming, and the purpose of this stage is to make sense of it.

If you are performing a comparative LCA, it is necessary to compare the impacts of the two product in each impact category for which you have gathered data. Unfortunately it is rarely the case that one product performs worse on all impact categories than the other, whilst one product may have less CO_2 emissions, the SO_2 emissions from this product may be greater. See Box 8.5 for a further example of this. Some degree of prioritization of the environmental impacts will therefore be necessary in order to establish which product has the lower overall impact.

Box 8.5 Comparing Inventory Data

LCAs undertaken for washing machines have clearly established that the most significant environmental impacts for all washing machines are associated with their consumption of energy and water during use. Should one particular washing machine use less water and energy than a competitor, it is clear that its environmental impact is the lower of the two. However, should one be more energy efficient and thus make a lower contribution to global warming while a second uses

less water and detergent and thus has a lower impact on water consumption and pollution, then it is not immediately obvious which has the lower overall environmental impact.

Impact prioritisation

There are a wide variety of ways to compare the environmental performance of competing products. At the most basic level, you may decide that only one impact category is of importance, say greenhouse gas emissions, and compare the products just on this one category. However, this would be a fairly narrow approach and would rarely meet the original aims of an LCA.

A more suitable approach for SMEs would be to rank the impact categories in order of importance. To do this you need to decide on who is going to do the ranking. The ranking could be done using just people internal to the company or you may want to include external stakeholders such as customers, local residents, regulators. Once the relevant decision makers have been selected you ask them to rank the impacts. The impacts can be ranked either by sending a questionnaire to the decision makers, asking them over the telephone, or you could bring them together in a workshop forum. The latter is more likely to produce a group consensus, but will be more costly than sending out questionnaires.

Having ranked the impacts it should then be possible to assess which product or process is most environmentally sound based on their performance against the key impacts. (For more information on ranking impacts see 6.3.2 on weighting and indexes.)

INPUTS		
	Recycling	**Incineration**
Nuclear Electricity (MJ)	58.3	1,810
Other/Hydro Electricity (MJ)	40.4	248
Coal Reserves (kg)	955	955
Oil Reserves (kg)	103	220
Gas Reserves (kg)	2.12	3.72
Other Non Renewable Resources (kg)	31.4	0.09
Renewable Resources (kg)	967	790
Ancillaries (kg)	388	31.8
Water (kg)	19,800	20,600
Air (net) (kg)	2,110	681
OUTPUTS		
	Recycling	**Incineration**
Atmospheric		
CO	22.4	-21.2
CO_2 (Non Renewable)	2,810	2,220
CO_2 (Renewable)	1.33	-1,270
NO_x	8.66	7.23
SO_2	13.9	27.8
VOC	51.9	30.6
Dust	0.39	-1.04
Halide	0.11	0.22

Other air	3,400	119
Solids		
Oils & greases	0.0179	0.0378
Heavy metals	0.0184	0.0194
Landfill weight	1,104	875
Landfill volume (dm^3)	1,380	1,090
Open Loop Outputs	13.3	-852
Other	0.301	0.174
Water		
TDS	10.2	11
TSS	170	1.59
COD	29	5
BOD	14.5	1.88
Waste water	16,700	20,600
Other water	1.65	0.934

Note: The functional unit for this LCA was 1 tonne of paper available to the public at the retailer stage.

Table 8.1 An Example Inventory- a comparative LCA of incineration v recycling of waste paper[v]

Box 8.6 Streamlined LCAs

Some LCAs can be expensive, time consuming and cumbersome to carry out. There are a number of methods to simplify the LCA, making it into a quick, cheap tool. These measures will be of particular relevance to SMEs, who do not have the staff or resources to conduct complete LCAs

- Shorten the life-cycle that is to be considered to a few key stages. It is important that any stages that have a significant environmental impact are not neglected.
- Use a model or database to avoid time consuming data collection (however, be aware that many of these models can be expensive to use)
- Focus on a few key environmental impacts, rather than considering every environmental impact

Issues to be aware of when carrying out an LCA

There has been a tendency to use LCA to "prove" the superiority of one product over another. and this has sometimes brought the concept into disrepute. Throughout the process of carrying out an LCA various decisions will have to be made - over the system boundaries, impacts to include, prioritisation of impacts etc. These decisions can greatly influence the final results of the LCA. It is therefore important that any such decisions are as objective as possible, defensible and made transparent when publicising the results.

This subjectivity of LCA should not deter its use. LCA has a number of advantages over and above those derived from traditional environmental

[v] Johnson, C.J. (1993) "An LCA of Incinerating or Recycling Waste Paper", Imperial College, London, UK.

management approaches. For the smaller firm a complete life-cycle may be beyond its resources, but the methodology can be adapted to reduce its scope (and therefore cost).

As pressure mounts for more environmentally friendly goods, it is likely that life-cycle information will be needed in order to enable consumers to make more informed choices. This availability of such information is likely to be enhanced by the trend towards more open disclosure of environmental information by companies. Here, LCA is a vital tool. LCA focuses managerial minds on all aspects of the product's environmental profile and the undertaking of the inventory process automatically allows future decision-making to better incorporate the environmental dimension and therefore to lessen impact.

Case Study 8.4 Climcon A/S[vi]

Air conditioning in passenger vehicles has significant environmental impacts. Not only are ozone depleting or greenhouse gases commonly used as cooling agents, but an air conditioning unit increases the overall energy consumption of a vehicle by as 47 litres of petrol per 10,000 km driven - equivalent to approximately 10% of vehicle energy consumption.

In 1994 Climcon A/S, a Danish SME, began exploring the possibility of using ceramic semiconductors ("Peltier elements") in vehicle air conditioning units. Prototype testing suggested that the "Climcon unit" could be produced at an equivalent or lower cost to conventional units and would be considerably more energy efficient, meaning lower running costs and improved environmental performance.

A product development programme known as Quality Function Deployment (QFD) was intiated using a grant from the Danish EPA. The QFD process involves ascertaining the wishes and concerns of potential future customers regarding the product under development through interviews with persons from key interest groups. This allows stakeholder concerns to be incorporated at the product design stage. In the case of the Climacon unit, eight structured interview were carried out - with the Danish Car Owners Association, a car rental company, a car dealer, a garage mechanic and four car owners.

In addition to taking in to account customer concerns, Climacon also took into account enviornmental concerns by having a life cycle assessment of its unit carried out. The first step of the LCA involved a preliminary comparison of the Climacon unit with a conventional air-conditioning unit. The comparison showed that the energy consumption of the Climacon unit was only one-third that of a conventional unit. It also showed that where the same material was used in both units, a smaller quantity was used in the Climacon unit. The second step of the LCA focused on using those materials and components that reduced the lifecycle impacts of the unit. Key criteria for the choice of materials and components were weight, recyclability and the absence of hazardous substances. Suiable decision support tools were developed and used in a dialogue between the LCA practitioner and the product developer, who identified possible alternatives for most components in the unit.

The Climacon cooling unit is thus optimized with respect to both quality and its most significant environmental impacts, and Climacon are confident that the unit's positive environmental profile will be of great value when the product is introduced to the market. The fact that the unit can save as much as 1000 litres of petrol in the

[vivi] Case study prepared by Anders Schmidt of dk-TEKNIK, Soborg, Denmark

lifetime of a standard car, makes it an attractive proposition both economically and environmentally.

Further Information

Environmental Life Cycle Management: A Guide for Better Business Decisions This excellent, easy-to-understand guidebook is published by Environment Canada and is designed primarily to help managers and other employees in SMEs take a life cycle approach in their business decision-making. The Guide is available in French or English for $15 (Canadian) plus postage and copies can be obtained from:

Environmental Protection Publications, Environment Canada.

Tel: +1 819 953 5750
Fax: +1 819 953 7253

Payment can be made by cheque, money order, Visa or Mastercard.

Life Cycle Assessment: What it is and How to do it (United Nations Environment Programme, 1996). This is an excellent guide to LCA with a wide selection of interesting case studies. Like this handbook, it is based around the questions: What...? Why...? How...?

The Life Cycle Assessment Handbook The European Environment Agency (EEA) has recently published a handbook on LCA. Section One of the handbook gives information on the various applications of LCA, Section Two contains information on LCA methodology and Section Three is a directory of various LCA inforamtion sources. For more details contact the EEA.

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DK - 1050 Copenhagen K
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e-mail: eea@eea.eu.int

or look on the EEA website at: http://www.eea.eu.int

9. Environmental Labelling Schemes

9.1. What are environmental labelling schemes?

Environmental labelling schemes award an environmental label to those products that are judged to be less harmful to the environment than others within the same product group.

The world's first environmental labelling scheme, known as the Blue Angel, was introduced in the then Federal Republic of Germany in 1978 and 9 schemes now exist within the Europe Union. The European Union's scheme - the EU Ecolabelling Scheme - operates throughout the EU and was launched in 1993 (see Table 9.1)

Region/country	Name of scheme	Established	No of product groups	No of products awarded label
Austria	The Austrian Eco-label	1991	34	79
Catalonia	Medi Ambient	1993	7	75
Finland, Iceland, Norway, Sweden	The White Swan	1989	46	418
France	The NF-Environment Mark	1991	8	155
Germany	The Blue Angel	1977	70	4000+
Netherlands	Milieukeur	1992	42	99
Spain	AENOR Medio Ambiente	1993	7	19
Sweden	Good Environmental Choice	1992	16	1418
European Union	EU Ecolabelling Scheme	1993	9	192

Table 9.1 Environmental labelling schemes within Europe

These schemes all operate in a similar fashion. First a product group is defined. (A product group consists of competing products that serve similar purposes. The German scheme has the largest number of

product groups and these include everything from returnable bottles and recycled paper to asbestos-free clutch linings and low noise lawn mowers). A life cycle assessment of the product group is then carried out to determine the most significant environmental impacts over its life cycle. On the basis of this assessment, a set of environmental criteria is established for the product group. Those products within the product group that meet these criteria are eligible for an environmental label.

Criteria are drawn up so only the less environmentally damaging products within a particular group will be eligible for the environmental label. For instance in the EU Ecolabelling Scheme, criteria are being set at levels where up to 30% of brands or models on the market meet them. Product group definition and the setting of environmental criteria is usually carried out by a board comprised of representatives of government, business, the academic and scientific communities, environmental and consumer groups. In this way the opinions of various interest groups are taken into account.
Labelling schemes are voluntary. A firm that wishes to have an environmental label awarded to its product must apply to the labelling scheme and the label will be awarded if the product meets the relevant criteria. The label can then be displayed on the product. Labelling schemes are open to all products in a product group so firms distributing products manufactured in another country can apply for labels for those products. All the above schemes charge an a fee for an application for a label. In addition an annual charge is levied relating to the turnover of the labelled product.

The environmental criteria for a particular product group are valid only for a limited period. During this period, a substantial number of products within the group may gain a label. In this case, the new criteria will need to be tougher to ensure that only best products (say the top 30%) are able meet them - thereby ensuring that the ecolabel remains a mark of excellence within a product group. The common features of the various labelling schemes are summarized in Box 9.1

Box 9.1 Common features of environmental labelling schemes

In 1991 The United Nations Environmental Programme (UNEP) held a "Global Environmental Labelling" seminar where experts defined the characteristics common to labelling schemes:

- determination of environmental criteria based on life-cycle review of a product group
- schemes are voluntary - companies not required to apply for a label but chose to do so
- run by not-for-profit organizations (including governments) without commercial interests
- recommendations for product groups and environmental award criteria determined by an independent, broadly-based board

- a legally protected symbol or logo
- open access to companies from all countries
- award criteria levels established to encourage the development of products and services that are significantly less damaging to the environment
- periodic review and, if necessary, update of both product groups and environmental criteria taking into account technological and market place developments

9.1.1. Aims of labelling schemes

Environmental labelling schemes have 2 aims:

1. *to provide consumers with a reliable and independent assessment of the environmental impact of products*.
   A number of labelling schemes were set up to combat misleading claims by manufacturers about their products (see Box 9.2). Consumers can have greater confidence in labelling schemes as they are administered by independent, reputable, non-profit making (often government) organizations which can offer an objective assessment of products based on a thorough life cycle review.

2. *to promote the production and use of products that have a reduced environmental impact*
   Labelling schemes aim to achieve this by enabling producers to harness consumer demand for "environmentally-friendly" goods. The idea is that certain producers will obtain an environmental label for their products in the hope that this will in increased demand. If the label has this effect, other producers may respond by improving the environmental performance of their products in order to obtain a label in an attempt to regain their market share. This results in a reduced environmental impact from the products within the product group.

Box 9.2 Claims made by manufacturers about their products

Manufacturers' environmental claims about their products began to appear in numbers with the rise of consumer awareness of environmental issues in the 1980s. Ever since then there has been disquiet expressed about some of these claims. A 1996 study by the UK National Consumer Council on environmental claims made by manufacturers about their products concluded that

"of the claims being made...many are confusing, a fairly large proportion are misleading, or potentially so, and a few are downright dishonest"

and that generally such claims are

"unverifiable, vague, woolly, specious or misleading".

- Examples of vague and woolly claims by manufacturers include such phrases as "easy on the environment" and "specially formulated with priority given to the environment".

- A number of aerosol manufactures have claimed that their product is "CFC-free". Whilst true, this claim could easily be misleading as it seems to imply that this is a distinguishing environmental feature of the product and that other products do not possess this attribute. In fact, all consumer aerosols must be CFC-free by law.

- Similarly, a number of paint manufacturers have advertised their paint as containing no added lead when adding paint to lead has been illegal for some time. And a number of detergents have been advertised as being "biodegradable" when in fact all detergents sold in the UK are biodegradable.
- Once company even claimed that its lead-free petrol caused "no pollution to the environment".
- Perhaps the most bizarre claim of all was by an American manufacturer which claimed that its cornflakes were "dolphin friendly"!!!

9.2. Why should my firm consider obtaining an environmental label for its product(s)?

Labelling schemes are definitely relevant to SMEs. Although most national labelling schemes do not keep an official record of how may SMEs take part in their schemes, staff from various schemes report that SMEs do take part. The Austrian labelling scheme, which does keep records, reports that 60 companies with less than 100 employees have participated in the scheme, with half of these companies having less than 20 employees.

An SME should consider applying for an environmental label if it feels the expected benefits of doing so outweigh the costs. Costs of taking part in a labelling scheme involve:

1. any costs involved in ensuring that a product meets the environmental criteria set for its product group. Your firm may make a product that already conforms with the relevant environmental criteria, but if not then some expense may be incurred in making the necessary adjustments to ensure that it does.
2. the charges made by the labelling scheme organizations.

These costs have to be weighed against the potential benefits of labelling. A firm will benefit from a label if the label encourages environmentally aware consumers to purchase its product thereby increasing sales. Or it may be necessary to get a label just to maintain market share if competitors are applying for labels for their goods. There is some evidence that products bearing environmental labels have gained an increased share of their market. Box 9.3 contains evidence on the German Blue Angel Scheme.

Box 9.3 Evidence from Germany

A booklet on the German Blue Angel scheme published by the German Institute of Quality Assurance and Labelling (one of the organizations administering the scheme) contains the following question and answer.

Q *Are there any indications that the environmental label has resulted in a shifting of market shares in favour of the products bearing the environmental label? What is the advertising impact of the label?*

A This question cannot be answered for all product groups, as there is often not enough information available from the manufacturers. However, for some product groups definite shifts in the marketing shares in favour of the products bearing the environmental label are evident. The market share for water-soluble lacquers has increased from approximately 1% in 1981 (the year the environmental label was introduced) to today 30% among do-it-yourselves. Another example are the readily biodegradable lubricants for motor saw chains. Following introduction of this environmental label in 1987, these products have in the meantime reached a dominating position in the market.

9.3. How do I find out more information about labelling schemes?

It is not possible to give detailed information here about national labelling schemes. Contact details for the national schemes listed in Table 9.1 are given in Appendix 9.1. However further details are given below on the labelling scheme that applies throughout the EU, the EU Ecolabelling Scheme.

The EU Ecolabelling Scheme was launched on 1st July 1993. It is administered by the Commission and by organizations (known as "*competent bodies*") set up by each Member State which run the scheme in their particular country. The scheme is intended to:

- promote the design, production, marketing and use of products which have a reduced environmental impact during their entire life cycle: and
- provide consumers with better information on the environmental impacts of products

Which products are covered by the scheme?
The scheme does not apply to food, drink or pharmaceutical products. In addition, ecolabels cannot be awarded to products classified as dangerous by the EU or to products manufactured by processes which are likely to significantly harm humans and/or the environment. Products manufactured outside and imported into the EU are covered by the scheme.

How does the scheme work?

The Ecolabelling Scheme operates by setting ecological criteria for product groups. A firm wishing to gain an ecolabel for one of its products must apply to its competent body. If the product is deemed to meet the ecological criteria set for its particular product group then an ecolabel is awarded.

What is a product group?
The Ecolabelling Scheme defines a product group as "*all competing products which serve similar purposes and which have equivalence of use*".

How are product groups and ecological criteria defined?
A product group is established by the Commission at the request of a competent body or on the initiative of the Commission itself. A competent body can act on its own initiative or at the request of any individual or organization.

Once the Commission has decided to establish a product group, the group and its ecological criteria have to be defined. The process of defining the group and its criteria is coordinated by a competent body appointed by the Commission. This competent body establishes an ad hoc group - consisting of its own experts, experts from other competent bodies, representatives from interest groups and from the Commission - to define the product group and criteria. The interest group members of this ad hoc group must include Community-level representatives of industry, commerce, consumer organizations and environmental organizations.

The ecological criteria developed for any product group must be established using a "cradle to grave" approach that takes into account environmental impacts that occur in specified environmental fields during the 5 stages of the product life cycle: pre-production, production, distribution, utilization and disposal - see Figure 9.1

	Product life-cycle				
Environmental fields	Pre-production	Production	Distribution	Utilisation	Disposal
Waste relevance					
Soil pollution and degradation					
Water contamination					
Air contamination					
Noise					

Consumption of energy					
Consumption of natural resources					
Effects on ecosystems					

Figure 9.1 EU Ecolabelling Scheme indicative assessment matrix

The criteria developed must:

- be precise, clear and objective so that they can be applied in a uniform manner by the competent bodies
- ensure a high level of environmental protection
- be based as far as possible on the use of clean technology
- reflect, where appropriate, the desirability of maximizing product life

The product group and criteria definitions established by this consultation process are then referred for approval to a committee (known as the "Regulatory Committee") composed of a representative from each Member State and chaired by a representative of the Commission . Once approved they are published in the EU's Official Journal. This process of defining product groups and ecological criteria is shown in Figure 9.2. Products groups for which environmental criteria have been developed or are under development are listed in Box 9.4

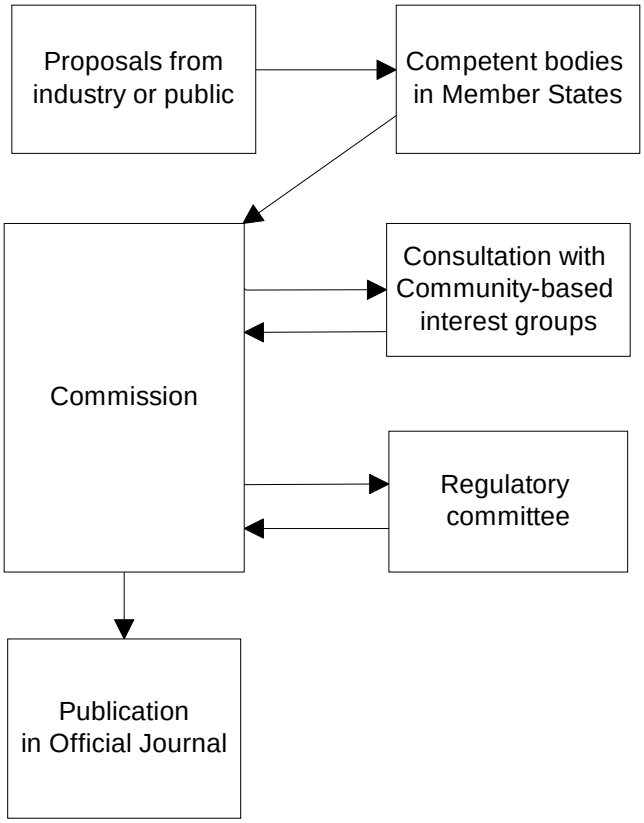


Figure 9.2 The process of defining product groups and ecological criteria[i]

At what level are the criteria set?
Generally speaking, criteria are being set at levels where up to 30% of the brands or models within a product group will pass. The criteria are usually valid for a period of 3 years. When this period has expired, a new set of tougher criteria may be set in order to encourage a continued reduction in the environmental impact of products within the product group.

[i] Welford, R and Gouldson, A (1993) *Environmental management and Business Strategy*, Pitman Publishing, London

Box 9.4 Product groups for which criteria have been developed or are under development

Product groups for which criteria have been agreed by the European Commission

- Laundry detergents
- Light bulbs (single ended)
- Paints and varnishes
- Light bulbs (double ended)
- T-shirts/bedlinen
- Washing machines
- Copying paper
- Refrigerators
- Tissue paper products

Product groups for which criteria are under development

- Growing media
- Shoes
- Shampoos
- Rubbish bags
- Batteries
- Dishwasher detergents
- Converted paper products
- Floor cleaning products
- Dishwashers
- Sanitary cleaning products
- Rubbish bags
- Mattresses
- Furniture care products
- Cat litter

Product groups for which criteria have been submitted for EU consultation

- Hairsprays
- Insulation materials

Product groups for which a study to develop criteria is in progress

- Textiles (other fibres)
- Personal computers

Note: To date 192 products have been awarded an ecolabel

How does my firm apply for an ecolabel?

The process of applying for an ecolabel is shown in Figure 9.3. EU-based manufacturers must apply for the award of an eco-label to the competent body of the Member State in which their product is manufactured or first marketed. Importers of a product from a non-EU country must apply to the competent body of the Member State into which the product is imported. The competent body then assesses the environmental performance of the product against the criteria for its product group. In some cases the competent body may require certificates of tests carried out on the product by accredited laboratories or the results of tests carried out by the manufacturer and verified by an independent laboratory.

If the competent body rejects an application, the firm that made the application is advised of the reasons for the rejection. If the competent body decides a label should be awarded it informs the Commission of its decision and can award the label 30 days after informing the Commission unless by that time it has been informed by the Commission of "reasoned objections" to the award. If these objections cannot be resolved after 45 days, then the matter is decided by the Regulatory Committee mentioned above and the Commission.

When the eco-label has been awarded to a product, the company manufacturing or importing the product can display the ecolabel on its product. The terms of use of the label are covered in a contract drawn up between the competent body and the company. The name of the product and of the manufacturer/importer is then published in the *Official Journal*.

What are the costs of applying for and using an eco-label?
A competent body charges a firm both for making an application for an ecolabel and for using the ecolabel. These charges vary between competent bodies. In the UK and application costs £500 and a firm must pay an annual licence fee of 0.15% of the value of sales of the ecolabelled product within the EU.

For further details on the EU Ecolabelling Scheme contact your relevant competent body (contact details are listed in Appendix 9.2) or visit the Ecolabelling Scheme's website at
http://europa.eu.int/en/comm/dg11/ecolabel/index.htm

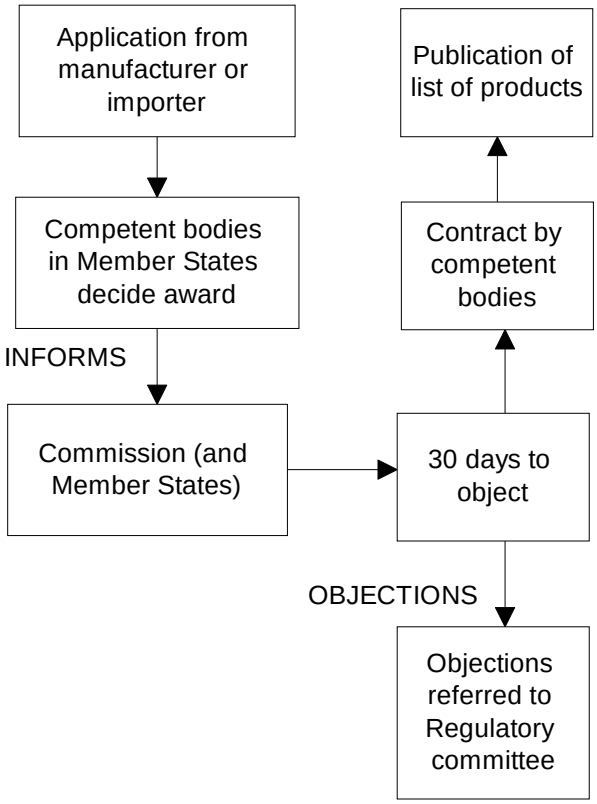


Figure 9.3 The process of applying for an ecolabel

APPENDIX 9.1 Contact Details for National Labelling Schemes

Austrian Eco-Label scheme
Austrian Association for
Promotion of Quality
Gonzagagasse 1/4
A-1010
VIENNA
Tel: +43 1 535 37 48
Fax: +43 1 533 74 07

The White Swan

Finland
SFS Environmental Labelling
Box 116
FIN-00241
HELSINKI
Tel: +358 0 149 9331
Fax: +358 0 1499 3320

Iceland
Hollustevernd Rikisins
Box 8080
IS-128
REYKJAVIK
Tel: +354 1 68 88 48
Fax: +354 1 68 18 96

Norway
Stiftelsen Miljømerking
Kr. Augusts gate 5
N-0164
OSLO
Tel: +47 22 36 07 10
Fax: +47 22 36 07 29

Sweden
SIS Eco-Labelling
Box 3295
S-103 66
STOCKHOLM
Tel: +46 8 613 5200
Fax: +46 8 21 30 70

NF Envrionment Mark (France)

Association française de Normalisation
Tour Europe (AFNOR)
92049 Paris La Defense Cédex
Tel: +33 1 42 91 59 26
Fax: +33 1 42 91 56 86

The Blue Angel (Germany)
RAL
Deutsches Institut für Gütesicherung und Kennzeichnung e.V.
Siegburger Staße 39
53757 Sankt Augustin
Tel: (0 22 41) 16 05-0

Milieukeur (Netherlands)
Stiching Milieukeur
Cisenhowerlaan 150
2517 kp Den Haag
Tel: + 070 358 6300
Fax: + 070 350 2517

AENEOR Medio Ambiente (Spain)
Asociación Española de Normalización y Certificatión (AENOR)
C/Fernández de la Hoz, 52
28010 Madrid
Tel: +34 (9) 1 310 48 51
Fax: +34 (9) 1 310 49 76

Good Environmental Choice (Sweden)
Naturskyddsföreningen
Box 7005
S-402 31 Goteborg
SWEDEN
Tel: +46 31 711 64 50
Fax: +46 31 711 64 30
e.mail: naturskyddsforeningen.gbg@snf.se

APPENDIX 9.2 Competent Bodies of EU Ecolabelling Scheme

Austria:
Bundesministerium fur Umwelt
Stubenbastei 5
A - 1010 Wien
tel: (43-1) 515 22 27 09
fax: (413-1) 515 22 76 05

Belgium:
Ministerie Volksgezondheid en Leefmilieu
Rijksadministratief Centrum
Vesalius 4
Pachecolaan 19 bus 7
B - 1010 Brussels
tel: (32-2) 210 48 74
fax: (32-2) 210 48 73

Denmark:
Ministry of Environment and Energy
Danish Environmental Protection Agency
Strandgade 29
DK - 1401 Copenhagen K
tel: (45-32) 66 01 00
fax: (45-32) 66 04 79

Finland:
Finnish Standards Association
SFS - Environmental Labelling
P.O.Box 116
FIN - 00241 Helsinki
tel: (358-0) 14 99 33 91
fax: (358-0) 14 99 33 20

France:
Association Française de Normalisation (AFNOR)
Tour Europe Cedex 7
F - 92049 Paris La Defense
tel: (33-1) 42 91 59 16
fax: (33-1) 42 91 56 86

Germany:
RAL, Deutsches Institut fur Gutesicherung und Kennzeichnung
Siegburger StraBe 39
D - 52757 Sankt Augustin
tel: (49-22-41) 16 05 23
fax: (49-22-41) 16 05 11

Germany:
Umweltbundesamt
Bismarckplatz 1
D - 14193 Berlin
tel: (49-30) 231 45 699
fax: (49-30) 231 45 787

Greece:
Ministry of Environment, Pysical Planning and Public Works
17 Amaliados Street
GR - 115-23 Athens
tel: (30-1) 641 17 17 / 642 65 31
fax: (30-1) 645 44 70

Iceland:
Environmetal and Food Agency
P.O.Box 8080
IS - 128 Reykjavik
tel: (35-4) 568 88 48
fax: (35-4) 568 18 96

Ireland:
National Standards Authority of Ireland (NSAI)
Forfas
Glasnevin
tel: (353-1) 807 28 89
fax: (353-1) 807 38 38

Italy:
ANPA
Via V. Brancati, 48
I-00144 Roma
tel: (39-6) 5007 2077
fax: (39-6) 5007 2048

Luxembourg:
Ministere de l'Environnement
18 Montee de la Petrusse
L - 2918 Luxembourg
tel: (352) 478 68 16
fax: (352) 40 04 10

Netherlands:
Stichting Milieukeur
Eisenhowerlaan 150
NL - 2517 KP's-Gravenhage

tel; (31-70) 358 63 00
fax: (31-70) 350 25 17

Norway:
Norwegian Foundation for Environmental Product Labelling
Kristian August Gate 5
N - 0164 Oslo
tel: (47-22) 36 07 10
fax: (47-22) 36 07 29

Portugal:
Direcçao-Geral da Industria
Av. Conselheiro Fernando de Sousa, 11
P - 1099 Lisboa
tel: (351-1) 385 91 61
fax: (351-1) 389 10 42

Spain:
Asociacion Espanola de Normalizacion y Certificacion (AENOR)
Fernandez de la Hoz 52
E - 28010 Madrid
tel: (34-1) 432 60 00
fax: (34-1) 310 49 76

Spain:
Direcccio General de Qualitat Ambiental
Departament de Medi Ambient
Generalitat de Catalunya
Av. Diagonal, 523 - 525
E - 08029 Barcelona
tel: (34-3) 419 30 85
fax: (34-3) 419 76 30

Sweden:
SIS Eco-Labelling
P.O.Box 6455
S - 113 82 Stockholm
tel: (46-8) 610 30 45
fax: (46-8) 34 20 10

United Kingdom:
UK Ecolabelling Board
7th Floor, Eastbury House
30-34 Albert Embankment
UK - London SE1 7TL
tel: (44-171) 820 11 99
fax: (44-171) 820 11 04

10. Environmental Reporting

10.1. What is an environmental report?

An ***environmental report*** is a document which a company produces to inform stakeholders about its environmental activities

It is generally accepted that environmental reports are:
stand-alone printed documents
annual publications
normally voluntary undertakings
the principal vehicle for company communication on the environment
a fair and credible reflection of the company's environmental activities

A comprehensive analysis of corporate environmental reporting and ranking is produced by EEA "Continuity, Credibility and Comparability - key challenges for corporate environmental performance measurement and communication (EEA Environmental Issues series)

10.2. Why produce an environmental report?

This section lists the various drivers that are pushing companies in the direction of reporting and the various benefits that can result from the reporting process.

The drivers for environmental reporting

Stakeholder demands
Calls for company environmental reporting have been around for some time. As early as 1991, the International Chamber of Commerce called on companies to report on their environmental management activities in its ICC Business Charter for Sustainable Development - see Box 10.1. (The complete Charter is set out in Chapter 11.)

Box 10.1 The ICC Business Charter for Sustainable Development

Principle 16. Compliance and reporting
To measure environmental performance; to conduct regular environmental audits and assessments of compliance with company requirements... and periodically to provide appropriate information to the Board of Directors, shareholders, employees, the authorities and the public.

Table 10.1 lists some of the various stakeholders that may require environmental information regarding your company and the reasons they require such information. This demand for information can often be met by the publication of an environmental report.

Stakeholders	Reasons for wanting environmental information
Employees	To satisfy themselves that their employer is responsible, and that any environmental or health risks are being managed effectively To assess how their work has contributed to overall environmental performance To understand the business reasons for any environmental actions and how such actions may affect their jobs
Local communities	To understand how the company's operations affect the local area's air, land and water quality To know that there are processes and programmes in place to manage environmental risks and impacts
Regulators	To establish what the company is doing to manage and improve environmental performance
Customers	To assess the suitability of the company as a potential supplier To compare the company's performance to that of alternative suppliers To be informed of possible risks/liabilities To be informed of the environmental impacts associated with products or services
Suppliers	To understand its customer's approach to environmental management
The financial community	To assess environmental risk in order to make informed decisions on insurance, lending and investment
Environmental campaigners	To identify examples of best practice To benchmark environmental performance

Table 10.1 Information needs of various stakeholders

Legal requirements

Until recently environmental reporting was always a voluntary undertaking. However, there is an increasing trend toward mandatory reporting within Europe. In 1996 Denmark became the first State to introduce legislation making environmental reporting mandatory (Box 10.2). As a result of the 'Green Accountancy' law it is estimated that over 2,000 Danish companies will now be required to produce annual environmental reports.

Box 10.2 The Danish Green Accountancy Law

On January 1, 1996 a statutory order from the *Danish Ministry of Environment and Energy* came into force, obliging companies undertaking certain activities to draw up green accounts. The accounts, which are aimed at the general public, are to be submitted annually to the *Danish Commerce and Companies Exchange* and must include an introductory statement and quantitative data on the consumption of

energy, water and raw materials and the production of significant types of pollution (as stipulated in the Danish Environmental Protection Act).

Activities covered by the Act include: production and processing of metals, wood and plastic, the processing of certain raw materials, the extraction and processing of mineral oils, asphalt and natural gas, chemical production, glue manufacture, printing, the processing of animal raw material, power and heat generation, waste (storage, treatment, recycling) and the industrial production of enzymes and genetically modified organisms.

The reports do not have to be independently verified and if a company is registered under EMAS it does not have to publish a green account.

Other countries are currently planning to make reporting mandatory for certain companies. In the Netherlands, 300 industrial companies will have to produce an annual environmental report from 1999 onwards and Sweden is planning similar measures.

Note that under the EC eco-management and audit scheme companies are required to produce an environmental report in the form of an environmental statement (see 4.1.2).

The rewards of environmental reporting

Environmental reporting demonstrates that a company is taking a proactive approach to the environment and allows it to publicize the positive environmental action it is taking. Reporting demonstrates a company's commitment to responsible environmental management and enables it to meet the increasing stakeholder demands for information regarding company environmental management activities. Producing an environmental report can help your company to maintain the confidence of its various stakeholder and allows it to respond to stakeholder concerns enhance your company's reputation. This can lead to improved relations with existing customers so helping to safeguard business, and to new business opportunities.

The very act of producing an environmental report means that your company will have to take a close look at its environmental activities. This can lead to the discovery of opportunities for efficiency gains, cost savings and reduction of risk. The fact that company environmental data is required for the report will stimulate your company to develop efficient systems for data measurement, collection and processing.

Reporting can motivate employees, particularly when they are given the opportunity to become involved in the preparation of reports.

Voluntary reporting enables companies to experiment with various methods and styles of reporting, placing them in an advantageous position should environmental reporting become mandatory.

10.3. How to produce an environmental report?

Producing an environmental involves the following 6 steps (Figure 10.1).

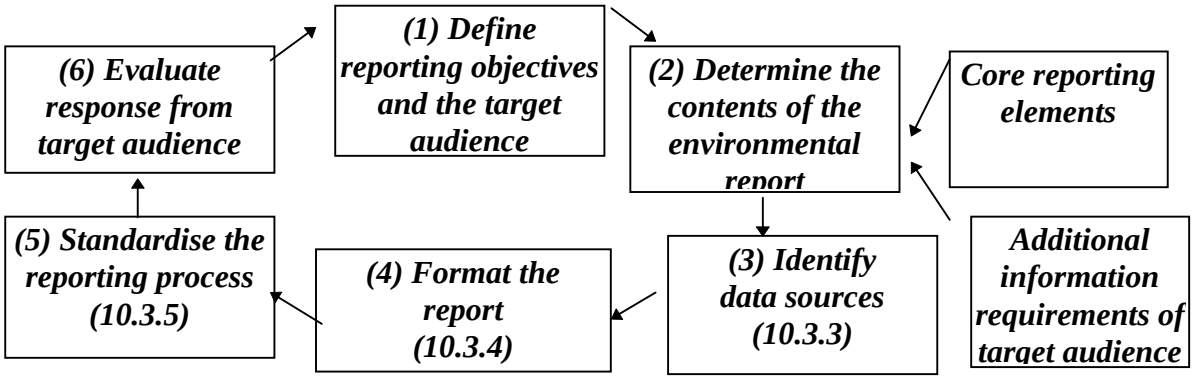


Figure 10.1 The 6 steps to producing an environmental report

The reporting process begins with a company clearly defining the objectives it wishes to achieve by publishing an environmental report (10.3.1). This exercise will guide the rest of the reporting process. The company then determines the content of the report (10.3.2) taking into account the core reporting elements (common to any environmental report) as well as any additional requirements of the target audience. The third step is to identify where the information required for the report is to come from (10.3.3) and in step four the format, layout, graphics, and structure of the report are decided upon and the report prepared (10.3.4). Stages five and six occur after the report has been published. Step five standardizes the collection of information for future reporting cycles (10.3.5), whilst step six evaluates the readers' response to the report (10.3.6).

The first environmental report is an experimental exercise for any company. Environmental reporting is a learning process with each cycle prompting discussion on what issues should be included, and how the document can be improved for future years.

10.3.1. Defining reporting objectives

The first step in the reporting process is for your company to clearly establish what it wishes to achieve by issuing an environmental report. This will include deciding the stakeholder groups at which the report is aimed and what your company wishes to achieve in relation to each group.

Table 10.2 demonstrates the potential range of a report's readership and the differing motivations you may have for wanting to report to them (we have already seen in Table 10.1 the reasons why these groups may want to receive a report).

It is extremely difficult if not impossible to produce an environmental report which completely meets the needs of all readership groups. You may therefore have to consider the possible trade-offs involved in prioritizing one set of objectives and readers over another.

Target audience	**What are we trying to achieve through reporting? (examples)**
Regulators	Inform of good environmental management practices
Employees	Increase awareness and motivation
Customers	Secure supplier contracts Increase market share Attract new customers
The financial community	Change perceptions of risk Enhance credit ratings Attract investors
The local community	Enhance understanding of company activities Prevent complaints
Shareholders	Increase share price Reassure shareholders Attract new shareholders
The media	Gain positive media coverage/prevent negative media coverage
Environmental lobbyists	Change lobbyists' perception of the company Give a factual base for discussions about company activities

Table 10.2 Target audiences and reasons for reporting to them

10.3.2. Determining the contents of the environmental report

If you are preparing an environmental report for the first time, the question of what should actually go into the document can often appear overwhelming. However, there are a number of core reporting elements which it is generally agreed should always be included in an environmental report. Each of these nine elements is described below:

1. Company profile
Your report should begin with a brief profile of your company, including its size, location and a description of its activities and its history.

2. Environmental policy

The report should contain the latest version of the company's environmental policy (see Chapter 3).

3. Environmental management system
Every company develops its own system of managing its environmental responsibilities and this should be briefly described. The report state who has overall responsibility for the system. You should state if your company is certified to ISO 14001 (don't forget that if you're EMAS registered you have to produce an environmental statement).

4. Legal compliance
Compliance with relevant environmental legislation is the minimum that is expected of any company and the report should therefore assure readers that your takes its legislative obligations seriously. Stakeholders are increasingly interested in bad as well as good news, and will therefore expect to see details of any prosecutions and fines relating to legislative breaches.

5. Inputs
Your company should provide an inventory of the environmentally significant materials used, with an indication, where appropriate, of which materials are hazardous or toxic. Information should also be provided on water and energy consumption.

6. Outputs
Your company should report on its total waste generation and on all of its environmentally significant emissions to both air and water. Information on individual waste streams should be provided where appropriate (particularly where hazardous or toxic materials are involved) and, in addition, details of any waste reduction and recycling initiatives

7. Environmental targets and objectives
Environmental progress is driven by your company establishing and then pursuing ambitious objectives and targets. These targets should be set out in the report along with a timetable for their achievement.

8. Company environmental spending
To demonstrate your company's commitment to responsible environmental management, the report should try to quantify total environmental expenditure. While this is an important issue for many reader groups, it is also difficult to quantify (for more discussion of this subject see 6.3.4 on financial indicators.) Where possible, the report should also indicate proposed spending.

9. Environmental liabilities
As with environmental spending this may be difficult to quantify, but it is an issue where stakeholders (especially those in the financial community) frequently demand information. Where possible the

company should try to report its net present value of known liabilities identify its potential liabilities.

It is important that the information provided under the above nine headings is relevant to the needs of your target audience. It is also important that you include any additional information that is relevant to your company's particular set of stakeholders. Tables 10.1 and 10.2 should assist you in determining any extra information you need to provide.

Note: Annex 10.1 provides a list of the United Nations Environment Programme's (UNEP's) "*50 Reporting Ingredients*" which can be used for inspiration as the reporting process expands with each cycle.

10.3.3. Identification of data sources

Having decided upon the information you wish to include in the environmental report, you will now have to identify where this information can be obtained. Generally, more environmental information exists within a company than is realized with relevant data being held in the company's various information systems such as the accounting and production planning systems (see 6.3.4)

Therefore your first step must be to locate the relevant information within these systems. Your company should then go on to define procedures for collecting data that does not already exist within the company system but is to be included within the environmental report. Wherever possible, try to integrate collection of environmental data into your current business systems (see Case Study 6.4).

10.3.4. Formatting the environmental report

Reporting Style

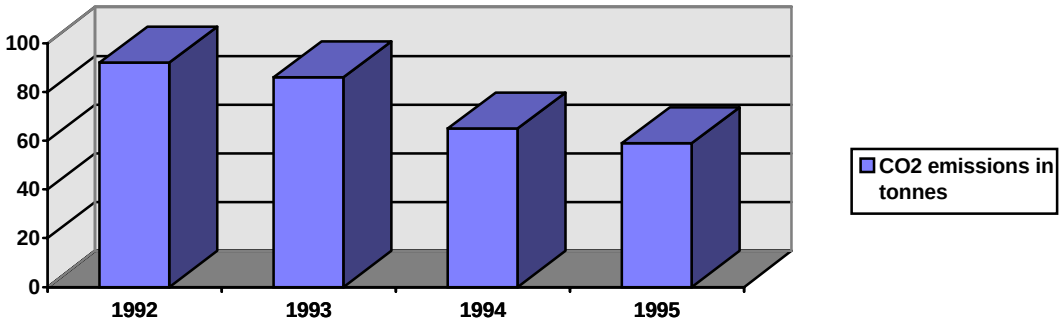
There is enormous scope for being creative in the production of an environmental report. Communicating environmental information, however, can often be a challenge since most readers will be unfamiliar with the scientific data or technical jargon used in environmental management circles. Therefore information needs to be expressed in a form that readers can understand. There are many innovative ways of achieving this - for example, as well as stating your energy consumption or savings in terms of MWh, they could also be expressed in terms of the energy required to heat a particular number of houses for a year.

Quantitative Data

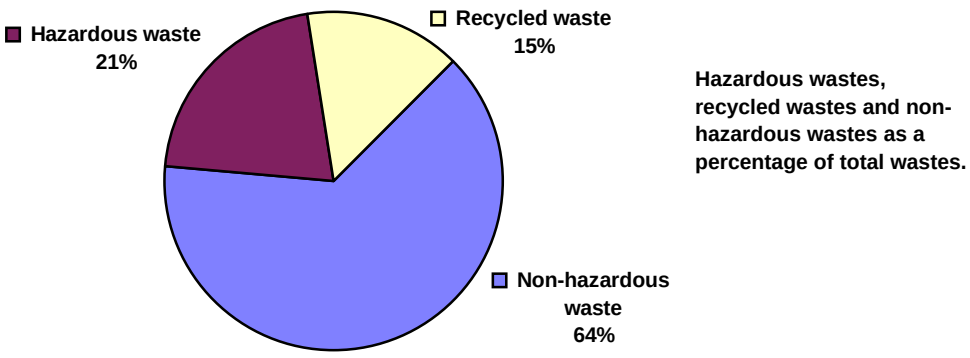
Quantitative data can be expressed both in absolute terms (e.g. total CO_2 emissions per year) and relative to production (e.g. CO_2 emissions per unit of production). Absolute data may be easier for most readers to understand but may also mask important information when used in isolation. Total emissions, for example, may rise over time due to increased production even where the emissions per unit of production may actually be falling. To help overcome this problem it is often advisable to provide both types of data within a report (see 6.3.2 for more information).

Graphical presentations

There are two principal graphical presentation forms used in environmental reporting - bar charts and pie charts. Bar charts are suitable for presenting such things as information that can be compared over time - for instance emissions over a number of years. It is obviously important to ensure that the information used is actually comparable, that the graph shows something that can not be demonstrated in a more effective way by figures, and that the x and y axis are meaningful to the reader. An example of the use of a bar chart is provided below.



Pie charts are suitable for illustrating how something may be broken down into its sub categories. An example is total waste and its divisions into non-hazardous, hazardous and recyclable waste categories - see below.



Graphical presentations can effectively summarize the wealth of technical data that exists and when used correctly can:
help focus attention within a report
facilitate the understanding of complex issues
help highlight trends or relationships
overcome language barriers.

Some general points to note when formatting an environmental report:

Be concise
Avoid overloading the audience with information. A common reporting pitfall is trying to squeeze too much information into too small a space. Sometimes less can be more if it means the reader can gain a clear understanding of the central issues.

Make good use of space
Make sure there is plenty of white space on a page. This can help to take pressure off the reader and generally makes the document far more approachable. The proper use of a picture or a graph can often replace paragraphs of text.

Standardize your measurements
Ensure that when information is collected, the same measurement techniques, sampling base and measurement units are used so as ensure it is directly comparable.

Be environmentally friendly
It is always a good idea to ensure that the report is produced on recycled paper!

10.3.5. Standardization of the environmental reporting process

The preparation of each year's environmental report should not have to be a laborious affair. The reporting process can be made as painless as possible by putting an efficient reporting system in place. An important part of the reporting process is data collection, which, as mentioned earlier in this chapter (10.3.3), can be achieved efficiently by integrating it into your current business systems wherever possible. With a well functioning reporting system, environmental reporting can become another one of your routine business functions.

10.3.6. Evaluating the effectiveness of the environmental report

There is always scope for improvement in environmental reporting. Ultimately, environmental reporting should aim to satisfy the information needs of your target audience and so it makes sense to seek your readership's opinion regarding your report. A 'reactive' or 'proactive' approach can be taken

The reactive approach involves waiting for the readership to respond to your report and is cheaper, less time consuming and easier to carry out. Typical techniques include - supplying a contact name and phone number within the report, providing a pre-paid reply slip, or as is increasingly common, inserting a detachable questionnaire for the reader to complete and return (See Box 10.4).

The proactive approach involves actively contacting a representative sample of your readership to establish their views and while generally more expensive and complicated to carry, can provide more meaningful and reliable results. Techniques range from simple telephone polls, and targeted postal questionnaires, to in-depth, one-to-one interviews, and specific "stakeholder workshops" - where representatives of different reader groups are invited to attend and express their views.

Perhaps one of the most extensive stakeholder consultation processes was undertaken by IBM in the UK. IBM employed the environmental consultancy ECOTEC on a one year project to identify and prioritise stakeholder requirements, and develop a systematic means of responding to these issues. The result was an eleven page report entitled "*Consulting the Stakeholder*" which defines IBM approach. Whilst consultation on this scale is beyond most if not all SMEs, a scaled-down version of this approach may prove valuable.

To summarize, evaluating your environmental report
enables you to monitor its effectiveness
provides a valuable feedback mechanism that allows you to improve the content of future reports
enables you to have confidence that you are meeting the information needs of your stakeholders

Box 10.4
Procter and Gambles' Detachable Reporting Questionnaire

We are very interested in your opinions of the Procter & Gamble Environmental Report. Please take a few minutes to share your thoughts by answering the questions below.

Consider everything about this Environmental Report, what is your overall reaction to it? (Check one box)

☐ Very Positive ☐ Somewhat Positive ☐ Neither Positive nor Negative

☐ Somewhat Negative ☐ Very Negative

In the space below, please explain why you selected the answer you did?

Please write any other comments you have below:

Country

Thank you for taking the time to complete this. Please mail this card at your earliest convenience.

Appendix 10.1 Voluntary reporting guidelines

Since 1990, a number of organizations have published environmental reporting guidelines. A selection of these are summarized below:

World Industry Council for the Environment - WICE
Issued in 1995. The guidelines recommend that company reports covers the following:

Qualitative	**1.**	Foreword by a senior responsible person
	2.	Profile of enterprise including size, activity and location of operations
	3.	Environmental policy
	4.	Environmental targets and objectives
	5.	Views on environmental issues
	6.	Community relations
Management	**7.**	Environmental management systems emphasising programmes, practices and organization.
	8.	Management of environmental risks
	9.	Office and site practices
Quantitative	**10.**	Environmental indicators and targets on e.g. emissions, effluents and discharges presented in the context of business performance.
	11.	Uses of energy and natural resources including conservation and substitutions
	12.	Compliance with regulations and permits
	13.	Financial indicators such as liabilities and provisions
Products	**14.**	Products, processes and services including product design, recycling, auditing practices etc.
	15.	Sources of further information

Public Environmental Reporting Initiative - PERI

Issued in 1993. The guidelines recommend reporting on the following issues:

1. Organisational profile which allows a report's environmental data to be placed in context.
2. Environmental policy
3. Environmental management showing how environmental policy implemented, the environmental management structure, and comments on such items such as TQM, overall environmental objectives, and education and training initiatives.
4. Environmental releases to air, water and land
5. Resource conservation including materials conservation, energy conservation, water conservation and forest, land and habitat conservation
6. Environmental risk management which describes environmental audits, environmental emergency responses, and workplace hazards
7. Environmental compliance with laws and regulations
8. Product stewardship focusing on environmental impacts and initiatives relating to product life cycle

9. Employee recognition and motivation schemes
10. Stakeholder involvement describing the organization's efforts to involve other stakeholders in environmental initiatives

European Coalition of Chemical Industries - CEFIC

Issued in 1992. A report should contain information on the following:

1. Foreword with addresses, environmental policies and company objectives
2. Site description with information on production, product usage, employment, environmental situation, relations with authorities, legal requirements, and controlling authorities
3. Environmental management details including structure, programme, objectives, techniques employed, and emergency plans
4. Data on emissions, energy generation, and consumption, health & safety, complaints, environmental protection spending. The data should be disclosed with comparison data from previous years
5. Communications such as community relations and open days
6. General comments
7. People to contact for further information

United Nations Environmental Programme - UNEP
The UNEP 50 reporting elements (Issued 1994)

The United Nations Environmental Programme's 1994 survey of environmental reporting identified a total of 50 reporting elements ("Reporting Ingredients") which it suggested should be addressed in the environmental reporting process. These can grouped into 5 main clusters:

(1) Management and system issues:

CEO statement
Environmental policy
Environmental management system
Management responsibilities
Environmental auditing
Goals and targets
Legal compliance
Awards
R&D
Programme and Initiatives
Verification
Reporting policy
User friendliness

(2) Input / Output Inventory

Inputs

Material use
Energy consumption
Water consumption

Process management

Health & Safety
EIAs & Risk management
Accidents & Emergency response
Land contamination & Remediation
Habitats

Outputs

Wastes
Air emissions
Water effluents
Noise & Odor
Transportation

Products

Life-cycle design
Packaging
Product impacts
Product stewardship

(3) Finance

Environmental spending
Environmental liabilities
Environmental cost accounting
Economic instruments
Benefits & opportunities
Charitable contributions.

(4) Stakeholder relations

Employees
Legislators & regulators
Local communities
Investors
Suppliers
Consumers
Industry Associations
Environment groups
Science & education
Media

(5) Global Citizenship

Global environmental issues
Global development issues
Technology cooperation
Global operating standards

The survey then went on to identify 20 of these ingredients as "Core Requirements", which it suggested would also provide a suitable checklist for SMEs undertaking the reporting process.

The 20 Core Requirements:

1	The latest environmental policy statement	**11**	Air emissions
2	Description of the environmental management system	**12**	Water effluent
3	Statement of management responsibilities	**13**	Product impacts during use
4	An account of the legal compliance record	**14**	The level of environmental expenditure
5	Material use and trends	**15**	Environmental liabilities
6	Energy consumption and trends	**16**	The company's relationship with: employees,
7	Water consumption and trends	**17**	government,
8	Health and safety statistics	**18**	local communities,
9	Environmental accidents	**19**	investors, and
10	Description of major waste streams	**20**	business and industry

11. Environmental Charters

11.1. What are environmental charters?

An ***environmental charter*** contains a set of principles relating to environment management. By signing up to a charter a company publicly declares its intention to carry out its environmental management activities in accordance with these principles.

Three charters are reproduced in the Appendix. The first two reproduced are:

- *The International Chamber of Commerce (ICC) Business Charter for Sustainable Development: and*
- *The Coalition for Environmentally Responsible Economies (CERES) Principles*

These charters have been included here as they are neither country nor industry specific i.e. any company from any country can sign up to them. National and industry specific charters also exist and these may also be of interest to your company. The ICC Charter only requires your company to support its 16 principles. In contrast the CERES Principles require your company to submit an annual environmental report which will be monitored to ensure its compliance.

The third charter reproduced here is the *Keidanren Global Environment Charter* (Keidanren is the Japanese Federation of Economic Organisations). Obviously, this is not a charter to which European companies can sign up but it is included here as we consider it to be an impressive charter which (along with the previous two) can provide a useful source of ideas and inspiration.

11.2. Why sign up to a charter?

Signing up to a charter is another way that your company can demonstrate that it is taking a responsible attitude to its environmental management. As has been pointed out throughout this handbook, demonstrating such a responsible attitude can improve the reputation of your company with its stakeholders.

Even if your company does not wish to sign up to a particular charter, charters can be used as a source of ideas and inspiration on environmental management, particularly when your company is writing its environmental policy (Chapter 3).

11.3. How do I sign up to a charter

To sign up to a charter just get in contact with the organization that has produced the charter and ask for details. For details on the ICC Charter contact:

The International Chamber of Commerce (ICC)
38 Cours Albert 1er
75008 Paris
France
Tel: +33 (1) 49 53 28 28
Fax: +33 (1) 49 53 28 59
or your national ICC office.

And for details on the Ceres Principles contact:

The Coalition for Environmentally Responsible Economies (CERES)
711 Atlantic Avenue
Boston, Massachusetts 02111
USA
Tel: + 1 617 451 0927
Fax: + 1 617 482 2028

The ICC Business Charter for Sustainable Development

1. Corporate Priority

To recognise environmental management as among the highest corporate priorities and as a key determinant to sustainable development; to establish policies, programmes and practices for conducting operations in an environmentally sound manner.

2. Integrated Management

To integrate these policies, programmes and practices fully into each business as an essential element of management in all its functions.

3. Process of Improvement

To continue to improve policies, programmes and environmental performance, taking into account technical developments , scientific understanding, consumer needs and community expectations, with legal regulations as a starting point; and to apply the same environmental criteria internationally.

4. Employee Education

To educate, train and motivate employees to conduct their activities in an environmentally responsible manner.

5. Prior Assessment

To assess environmental impacts before starting and new activity or project and before decommissioning a facility or leaving a site.

6. Products and Services

To develop and provide products or services that have no undue environmental impact and are safe in their intended use, that are efficient in their consumption of energy and natural resources, and can be recycled, reused or disposed of safely.

7. Customer Advice

To advise, and where relevant educate, customers, distributors, and the public in the safe use, transport, storage and disposal of products provided; and to apply similar considerations to the provisions of services.

8. Facilities and Operations

To develop, design and operate facilities and conduct activities taking into consideration the efficient use of energy and materials, the sustainable use of renewable resources, the minimisation of adverse environmental impact and waste generation, and the safe and responsible disposal of residual wastes.

9. Research

To conduct or support research on the environmental impacts of raw materials, products, processes, emissions, and wastes associated with the enterprise and on the means of minimising such adverse impacts.

10. Precautionary Approach

To modify the manufacture, marketing, or use of products or services or the conduct of activities, consistent with scientific and technical understanding, to prevent serious or irreversible environmental degradation.

11. Contractors and Suppliers

To promote the adoption of these principles by contractors acting on behalf of the enterprise, encouraging and, where appropriate, requiring improvements in their practices to make them consistent with those of the enterprise; and to encourage the wider adoption of these principles by suppliers.

12. Emergency Preparedness

To develop and maintain, where significant hazards exist, emergency preparedness plans in conjunction with the emergency services, relevant authorities and the local community, recognising potential transboundary impacts.

13. Transfer of Technology

To contribute to the transfer of environmentally sound technology and management methods throughout the industrial and public sectors.

14. Contributing to the Common Effect

To contribute to the development of public policy and to business, governmental and intergovernmental programmes and education initiatives that will enhance environmental awareness and protection.

15. Openness to Concerns

To foster openness and dialogue with employees and the public, anticipating and responding to the concerns about potential hazards and impacts of operations, products, wastes or services, including those of transboundary or global significance.

16. Compliance and Auditing

To measure environmental performance; to conduct regular environmental audits and assessments of compliance with company requirements, legal requirements and these principles; and periodically provide appropriate information to the Board of Directors, shareholders, employees, the authorities and the public.

The Coalition for Environmentally Responsible Economies (CERES) Principles

1. Protection of the Biosphere We will reduce and make continual progress towards eliminating the release of any substances that may cause environmental damage to air, water, or the earth or its inhabitants. We will safeguard all habitats affected by our operations and will protect open spaces and wilderness, while preserving biodiversity.	**6. Safe Products and Services** We will reduce and where possible eliminate the use, manufacture or sale of products and services that cause environmental damage or health or safety hazards. We will inform our customers of the environmental impacts of our products or services and try to correct unsafe use.
2. Sustainable Use of Natural Resources We will make sustainable use of renewable natural resources, such as water, soils and forest. We will conserve non-renewable natural resources through efficient use and careful planning.	**7. Environmental Restoration** We will promptly and responsibly correct conditions we have caused that endanger health, safety or the environment. To the extent feasible, we will redress injuries we have caused to persons or damage we have caused to the environment and will restore the environment.
3. Reduction and Disposal of Waste We will reduce and where possible eliminate waste through source reduction and recycling. All waste will be handled and disposed of through safe and responsible methods.	**8. Informing the Public** We will inform in a timely manner anyone who may be affected by conditions caused by our company that might endanger health, safety or the environment. We will regularly seek advise and counsel through dialogue with persons in communities near our facilities. We will not take any action against employees for reporting dangerous incidents or conditions to management or to appropriate authorities.
4. Energy Conservation We will conserve energy and improve the energy efficiency of our internal operations and of the goods and services we sell . We will make every effort to use environmentally safe and sustainable energy sources.	**9. Management Commitment** We will implement these basic Principles and sustain a process that ensures that the Board of Directors and Chief Executive Officer are fully informed about pertinent environmental issues and are fully responsible for environmental policy. In selecting our Board of Directors, we will consider demonstrated environmental commitment as a factor
5. Risk Reduction We will strive to minimise the environmental, health and safety risks to our employees and the communities in which we operate through safe technologies, facilities and operating procedures, and by being prepared	**10 Audits and Reports** We will conduct an annual self-evaluation of our progress in implementing these Principles. We will support the timely creation of generally accepted environmental audit procedures. we will annually complete

for emergencies.	the CERES Report, which will be made available to the public.

Keidanren (Japan Federation of Economic Organisations)
Keidanren Global Environment Charter

Basic Philosophy
A company's existence is closely bound up with the global environment as well as with the community it is based in. In carrying on its activities each company must have respect for human dignity, and strive towards a future society where the global environment is protected.

We must aim to construct a society whose members cooperate together on environmental problems, a society where sustainable development on a global scale is possible, where companies enjoy a relationship of mutual trust with local citizens and consumers; and where they vigorously and freely develop their operations while preserving the environment. Each company must aim at being a good global corporate citizen, recognising that grappling with environment problems is essential to its own existence and its activities.

Guidelines for Corporate Action
Companies must carry on their business activities to contribute to the establishment of a new economic social system for realising an environmentally protective society leading to the sustainable development.

1. General management policies

Companies should always carry on their business activities to contribute to the establishment of a new economic social system for realising an environmentally protective society leading to the sustainable development.

2. Corporate organisations

A) Companies shall establish an internal system to handle environmental issues by appointing an executive and creating an organisation in charge of environmental problems.

B) Environmental regulation shall be established for company activities, and these shall be observed. Such internal regulations shall include goals for reducing the load on the environment. An internal inspection to determine how well the environmental regulations are being adhered to shall be carried out at least once a year.

3. Concern for the environment

A) All company activities, being with siting of production facilities, shall be scientifically evaluated for their impact on the environment, and necessary counter-measures shall be implemented.

B) Care shall be taken in the research, design , and development stages of making a product to lessen the possible

burden on the environment at each level of its production, distribution, appropriate use, and disposal.

C) Companies shall strictly observe all national and local laws and regulations for environmental protection, and where necessary they shall set additional standards of their own.

D) When procuring materials, including materials for production, companies shall endeavour to purchase those that are superior for conserving resources, preserving the environment, and enhance recycling.

E) Companies shall employ technologies that allow efficient use of energy and preservation of the environment in their production and other activities. Companies shall endeavour to use resources efficiently and reduce waste products through recycling, and shall appropriately deal with pollutants and waste products.

4. Technology development

A) In order to help solve global environmental problems, companies shall endeavour to develop and supply innovative technologies, products and services that allow conservation of energy and other resources together with preservation of the environment.

5. Technology transfers

A) Companies shall seek appropriate means for the domestic and overseas transfer of their technologies, know-how and expertise for dealing with environmental problems and conserving energy and other resources.

B) In participating in official development assistance projects, companies shall carefully consider environmental and anti-pollution measures.

6. Emergency measures

A) If environmental problems ever occur as a result of an accident in the course of company activities or deficiency in a product, companies shall adequately explain the situation to all concerned parties and take appropriate measures, using their technologies and human and other resources, to minimise their impact on the environment.

B) Even when a major disaster or environmental accident occurs outside of a company's responsibility, it shall still actively provide technological and other appropriate assistance.

7. Public relations and education

A) Companies shall actively publicise information and carry out educational activities concerning their measures for protecting the environment, maintaining ecosystems, and ensuring health and safety in their activities.

B) The employees shall be educated to understand the importance of daily close management to ensure the prevention of pollution and the conservation of energy and other resources.

C) Companies shall provide users with information of the appropriate use and disposal, including recycling, of their products.

8. Community relations

A) As community members, companies shall actively participate in activities to preserve the community environment and support employees who engage in such activities on their own initiative.

B) Companies shall promote dialogue with people in all segments of society over operational issues and problems seeking to achieve mutual understanding and strengthen co-operative relations.

9. Overseas operations

A) Companies developing operations overseas shall observe the Ten-Points-Environmental Guidelines for the Japanese Enterprise Operating Abroad in Keidanren's Basic Views of the Global Environmental Problems.

10 Contribution to public policies

A) Companies shall work to provide information gained from their experiences to administrative authorities, international organisations, and other bodies formulating environmental policy, as well as participate in dialogue with such bodies, in order that more rational and effective policies can be formulated.

B) Companies shall draw on their experience to propose rational systems to administrative authorities and international organisations concerning formulation of environmental policies and to offer sensible advice to consumers on lifestyles.

11. Responses to global problems

A) Companies shall co-operate in scientific research on the causes and effects of such problems as global warming and they shall also co-operate in the economic analysis of possible counter measures.

B) Companies shall actively work to implement effective and rational measures to conserve energy and other resources even when such environmental problems have not been fully elucidated by science.

C) Companies shall play an active role when the private sector's help is sought to implement international environmental measures, including work to solve the problems of poverty and over population in developing countries.