DEDICATED TO MAKING A DIFFERENCE


# eco-efficiency

## LEARNING MODULE

World Business Council for
Sustainable Development

FiveWinds
INTERNATIONAL

# Contents

# Introduction to the learning module

An overview of the sustainability modules and how they can be used, with specific guidance on the eco-efficiency module.

# 1.0 About eco-efficiency

"This is what eco-efficiency is all about: combining the goals of business excellence and environmental excellence, and creating the link through which corporate behavior can support sustainable development."
Bjorn Stigson, President WBCSD

## Evolving concept

Eco-efficiency is a management philosophy that encourages business to search for environmental improvements that yield parallel economic benefits. It focuses on business opportunities and allows companies to become more environmentally responsible and more profitable. It is a key business contribution to sustainable societies.

As defined by the World Business Council for Sustainable Development (WBCSD), "eco-efficiency is achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle to a level at least in line with the Earth's estimated carrying capacity." In short, it is concerned with creating more value with less impact.

- Interface, one of the world's largest producers of commercial floor covering, saved over $200 million from 1996 to 2002 through its sustainability efforts.
- HP in California reduced its waste by 95% and saved $870,564 in 1998.
- STMicroelectronics, a Swiss-based technology manufacturer, saved £38 million in energy and $8 million in water costs, with a total saving over a decade predicted at $900 million.
- Dupont reduced energy use by one-third at one facility saving over $17 million per year on power while reducing greenhouse gas pollution per pound of product by half. In 2000, it saved almost $400 million due to resource and productivity improvement.
- In five years, SC Johnson increased production by 50% while waste emissions were cut by half, resulting in annual cost savings of more than $125 million.
- United Technologies Corporation's sites eliminated almost 40,000 gallons per year of waste water and saved over US$50,000 per year with a fundamental change in the way it manages its test cells, underground storage tanks and waste streams.

## Eco-efficiency in practice

There have been great advances in the application of eco-efficiency principles to the real world. Industry, for example, has had considerable success in reducing pollution and emissions, and eliminating hazardous materials from production processes. In the past, business viewed the environment and sustainable development as problems and risk factors. Today, they are also seen as opportunities – sources of efficiency improvement and growth. Eco-efficiency is very much a part of this picture. Basically, it is about doing more with less: delivering more value while using fewer resources. If you save energy, for example, you cut your costs while also reducing unwelcome outputs such as emissions.

Eco-efficiency is not limited simply to making incremental efficiency improvements in existing practices and habits. It should stimulate creativity and innovation in the search for new ways of doing things. Nor is eco-efficiency limited to areas within a company's boundaries, such as in manufacturing and plant management. It is also valid for activities upstream and downstream of a manufacturer's plant and involves the supply and product value chains. Consequently, it can be a great challenge to development engineers, purchasers, product portfolio managers, marketing specialists and even finance and control.

Companies can use eco-efficiency as an integral cultural element in their policy or mission statements. They can also set eco-efficiency objectives for their environmental or integrated management systems. And it is a useful tool for monitoring and reporting performance, and for helping the firm's communication and dialogue with its stakeholders.

Eco-efficiency opportunities can emerge at any point in the entire life-cycle of a product. This means employees need to understand what eco-efficiency is, the value it can bring to a company and how to make it happen. This in turn requires building skills and understanding in order to integrate eco-efficiency across business operations, sectors, countries and issues, and allowing space for innovation and creativity.

## A panacea?

The concept has moved from preventing pollution in manufacturing industries to becoming a driver for innovation and competitiveness. Companies implement eco-efficiency to optimize their processes, turn their wastes into resources for other industries, and drive innovation that leads to products with new functionalities. Eco-efficiency is a practical approach but not a panacea. And it will never work as an add-on to a business – it has to be an integral part of a strategy. Such a strategy will have a strong focus on technological and social innovation, accountability and transparency, as well as on cooperation with other parts of society with a view to achieving the set objectives.

## INTRODUCTION TO THE LEARNING MODULE

Eco-efficiency can help companies develop and successfully implement a business strategy toward sustainability only if it's in the hearts and minds of employees. Demonstrating the value of an eco-efficient approach will help employees recognize why it is important for the company to implement and motivate towards action. Eco-efficiency has been demonstrated, through hundreds of case examples, to work for companies of all sizes, in all industrial sectors and in all regions. It is critical to draw on the range of tools, strategies and examples that already exist within the leaders in this field. Eco-efficiency also requires a range of skills and capabilities from understanding definitions and dilemmas, analyzing stakeholder perspectives to undertaking a life-cycle assessment, integrating thinking across business operations, cooperating and negotiating with external partners, and measuring and evaluating impact.

Eco-efficiency is, in fact, work in progress and will continue to be so because it is in essence a dynamic rather than a static process. The purpose of the module is therefore to help companies advocate and educate the eco-efficiency story so far:

- the business drivers and value of adopting eco-efficiency
- the key strategies and tools for implementing eco-efficiency
- how to integrate eco-efficiency into business decision-making processes.

Eco-efficiency is not sufficient by itself because it integrates only two of sustainability's three elements, economics and ecology, while leaving the third, social progress, outside its embrace. By advocating and educating eco-efficiency, employees can better understand the impacts of the company and its relationship with society. This will enable business to look beyond eco-efficiency in order to earn its licence to operate, innovate and grow.

# 2.0
# Inside the eco-efficiency module

United Technologies Corporation (UTC) is driving continuous improvement in its environment, health and safety performance through targeted programs, including "Kaizen" events, community redevelopment, zero discharge wastewater treatment, and down-to-earth targets for spaceborne water systems.

## A flexible resource

The eco-efficiency module is a compilation of learning materials and exercises, from which the user may pick-and-choose, to raise awareness and foster implementation at different levels within their organization. There is a choice of activities, all of which are flexible enough to suit a wide range of audiences, to be delivered by people from a variety of functions and to be customized to the needs and concerns of a particular organization.

The module contains a background briefing paper designed to give a comprehensive overview of eco-efficiency and a resources section with case studies, quotes and references. In addition there are three learning units – understanding, exploring and implementing – with a combination of conceptual and practical tools and methods.

The understanding unit introduces the concept of eco-efficiency through a range of basic exercises around definitions, drivers and trends. In the exploring section, participants can understand eco-efficiency and seek to deepen their skills and knowledge through dilemmas and case exercises, applying different approaches and solutions. Implementing will teach participants how to take stock of current performance and to integrate eco-efficient decisions into an organisation.

| Section | Content | Who for |
|---|---|---|
| **Introduction** | Introduction to the modules and how to use them | • learning facilitators<br>• senior management |
| **Background briefing** | Comprehensive overview of key issues<br>Summary paper that includes context setting, the business case and key challenges | • learning facilitators<br>• participants with substantial interest or involvement |
| **Learning unit A** | Understanding the sustainability topic<br>Activities to understand definitions, drivers and trends | • learning facilitators<br>• all participants |
| **Learning unit B** | Exploring the sustainability topic<br>Activities to discuss and debate dilemmas | • learning facilitators<br>• participants with substantial interest or involvement |
| **Learning unit C** | Implementing the sustainability topic<br>Activities to take stock in your company and plan for future action | • learning facilitators<br>• participants involved in implementation |
| **Resources** | Range of additional resources for augmenting the learning units or for individual study | • learning facilitators<br>• participants with substantial interest or involvement |

| Learning element | Purpose | Audience level | Hours |
|---|---|---|---|
| BACKGROUND BRIEFING ON ECO-EFFICIENCY | | | |
| (For content, see the briefing) | Comprehensive overview of key issues | intermediate | – |
| Learning unit A: UNDERSTANDING ECO-EFFICIENCY | | | |
| Getting started with autographs | Warm-up activity to stimulate interest and introduce the participants | all | 15 mins |
| Presenting the evidence | PowerPoint slides to present eco-efficiency to a range of audiences | all | 1 hr |
| Understanding the facts | Group activity to share basic definitions, background and facts | starter and intermediate | 30 mins |
| Learning unit B: EXPLORING ECO-EFFICIENCY | | | |
| Identifying key elements of eco-efficiency | Tabletop management activity to introduce key elements in eco-efficiency and relation to other concepts | intermediate | 45 mins |
| Understanding a life-cycle approach | Group exploration of the environmental impacts of products | starter intermediate and advanced options | 30 mins to 2 hrs |
| Reviewing news stories | Group discussion of real issues at the level of corporate strategy and planning | intermediate and above | 45 mins |
| Debating dilemmas | Role-playing exercise at the level of hands-on improvement of a process | intermediate and above | 30 mins |
| Eco-innovation | Exercise in systemic inventive thinking – "thinking differently" | intermediate and above | 45 mins |
| Negotiating contracts for supply | Role play for experience including eco-efficiency options into contracts negotiations | starter and intermediate | 1 hr |
| Learning unit C: IMPLEMENTING ECO-EFFICIENCY | | | |
| Taking stock | Determine current eco-efficiency and plan an improvement strategy | intermediate and above | 1 hr |
| Applying the eco-efficiency tool box | Learn about tools available and where they apply | intermediate and above | 1 hr |
| Revalorizing by-products | Explore in more depth a key element | intermediate and above | 30 mins |
| Measuring impacts | Learn about some basic indicators | intermediate and above | 45 mins |
| Business integration | Work through how eco-efficiency integrates into existing business practices | intermediate and above | 1 hr |
| Assessing the limits | Review the pros and cons and consider the tougher challenges | intermediate and above | 1 hr |
| Planning for action | Prepare a to-do list for positive action | all | 30 mins |
| RESOURCES FOR ECO-EFFICIENCY | | | |
| Case studies and examples | Eco-efficiency good practice | all | – |
| Glossary and acronyms | Terms used in the modules | all | – |
| Quotes and speeches | Illustrating the business case | all | – |
| Organizations and websites | Tools, training, research and policy work | all | – |
| Publications | The WBCSD and other sources | all | – |

### Customize to your situation

In an ideal world, employees would go through all three of these learning units in a formal, structured process. In practice, eco-efficiency is a relatively new topic and demand is emerging organically from different parts of organizations at different levels, often informally. Select the tools and topics that are relevant for your business and audience.

It is crucially important to adapt the content and its delivery to the local situation – for your organization and the audience you are addressing. The module is essentially a starter kit, which we would expect most users to dip into selectively and fashion to the shape that suits them best. Use this guide to select the learning elements best suited for a particular group or purpose.

The tools are designed to capture interest, to inform and to engage. They also include practical approaches to help organizations to integrate eco-efficiency into their thinking, practices and processes.

# 3.0 Delivering the eco-efficiency module

Through reductions in energy consumption and improvements in processes, cement company CEMEX has reduced $CO_2$ emissions by 263,000 tonnes, equivalent to the $CO_2$ sequestered in one year by 33,000 hectares of pine forest.

## Who is it for?

The materials in the module are designed for employees within your organization who would benefit from a better understanding of eco-efficiency and its value in their day-to-day work. Identifying specific individuals or business groups will be dependent on your company structure, learning needs, industrial sector, location or approach to sustainable development.

The person delivering the materials will also vary depending on whether your company has a formal education process around sustainable development and eco-efficiency or is sporadically introducing elements within the organization. Many organizations will have among their staff both training professionals and technical experts who may be called upon to deliver co-efficiency advocacy and education. For this reason, we have provided information and guidance both about the topic of eco-efficiency and about how to deliver or process information.

In short, the learning modules could be delivered by a variety of individuals within a company, and the audience will vary depending on company structure and needs. For example:

- **Sustainability manager** may need to train an immediate "sustainability team", or other employees, to increase acceptance and understanding on eco-efficiency, environmental improvements or sustainable development issues.
- **Project or business unit manager** to increase awareness in project teams and business units, or to build skills on an issue based on location and business area.
- **Line manager or team leader** who, as part of a general career development plan, must strengthen staff knowledge and skills on eco-efficiency.
- **Human resource manager** to bring the entire organization up to a specific level of understanding and establish areas of key organizational importance for new staff – for example, graduate programs.
- **Communications or PR manager** to inform and engage communication staff in eco-efficiency, or when a company may reorient itself around sustainable development.
- **Business development manager** for topical training if issues related to sustainable development influence new directions of business development.

For guidance, consider the three sample agendas on the following pages.

# Suggested agenda for starter audience

**Total time**: 5 hours, including brief coffee break and half-hour lunch break

| | | |
|---|---|---|
| 08.30 | Getting started with autographs | Learning Unit A |
| 08.45 | Presenting the evidence | Learning Unit A |
| 09.45 | Identifying key elements of eco-efficiency<br>*Break within exercise* | Learning Unit B |
| 10.45 | Understanding a life-cycle approach, activity 1 | Learning Unit B |
| 11.15 | Reviewing news stories | Learning Unit B |
| 11.45 | Eco-innovation | Learning Unit B |
| 12.30 | *Lunch* | |
| 13.00 | Planning for action | Learning Unit C |
| 13.30 | *Adjourn* | |

# Suggested agenda for intermediate audience

**Total time**: 7¼ hours, including two brief coffee breaks and half-hour lunch break

| | | |
|---|---|---|
| 08.30 | Getting started with autographs | Learning Unit A |
| 08.45 | Presenting the evidence | Learning Unit A |
| 09.45 | Identifying key elements of eco-efficiency<br>*Break within exercise* | Learning Unit B |
| 10.45 | Understanding a life-cycle approach, activity 1 | Learning Unit B |
| 11.15 | Understanding a life-cycle approach, activity 2 and 3 | Learning Unit B |
| 11.45 | *Lunch* | |
| 12.15 | Understanding a life-cycle approach, activity 4 | Learning Unit B |
| 12.45 | Debating dilemmas | Learning Unit B |
| 13.15 | Eco-innovation | Learning Unit B |
| 14.00 | Taking stock | Learning Unit C |
| 15.00 | Applying the eco-efficiency tool box<br>*Break within exercise* | Learning Unit C |
| 16.00 | Measuring eco-efficiency | Learning Unit C |
| 16.45 | Planning for action | Learning Unit C |
| 17.15 | *Adjourn* | |

# Suggested agenda for advanced audience

**Total time:** Two days (one eight-hour day and one seven-hour day), including coffee breaks and one-hour lunch breaks

| | **Day One** | |
|---|---|---|
| 08.30 | Understanding the facts (ice-breaker quiz) | Learning Unit A |
| 09.00 | Presenting the evidence | Learning Unit A |
| 10.00 | Identifying key elements of eco-efficiency<br>*Break within exercise* | Learning Unit B |
| 10.45 | Understanding a life-cycle approach, activity 1 | Learning Unit B |
| 11.15 | Understanding a life-cycle approach, activity 2 and 3 | Learning Unit B |
| 12.30 | *Lunch* | |
| 13.30 | Understanding a life-cycle approach, activity 4 | Learning Unit B |
| 14.00 | Reviewing news stories | Learning Unit B |
| 14.45 | Eco-innovation | Learning Unit B |
| 15.30 | Negotiating contracts for supply<br>*Break within exercise* | Learning Unit B |
| 16.30 | *Adjourn* | |

| | **Day Two** | |
|---|---|---|
| 09.00 | Taking stock | Learning Unit C |
| 10.00 | Selecting tools for implementing eco-efficiency<br>*Break within exercise* | Learning Unit C |
| 11.00 | Revalorizing by-products | Learning Unit C |
| 11.30 | Measuring eco-efficiency | Learning Unit C |
| 12.15 | *Lunch* | |
| 13.15 | Business integration<br>*Break within exercise* | Learning Unit C |
| 14.30 | Assessing the limits | Learning Unit C |
| 15.30 | Planning for action | Learning Unit C |
| 16.00 | *Adjourn* | |

# WORKSHOP FEEDBACK

Eco-efficiency workshop:

Name:

Job title:

Organization:

## Your objectives

1 What were your key personal and professional objectives in participating in the workshop?

2 Did the workshop address these objectives? (If not, please explain why.)

3 What are the key outcomes or lessons you will take away from the workshop?

4 How will your own work benefit or change as a result of the workshop? (In general terms and/or any specific actions you plan to take.)

# WORKSHOP FEEDBACK

## The workshop

5 Which elements (if any) do you think were particularly successful?

6 Which elements (if any) do you think were not very successful?

7 Which element was most relevant to you personally?

8 Which element was least relevant to you personally?

9 Please write any suggestions for improving the way the workshop was run and facilitated.

10 Please write any suggestions for improving the workshop in other ways.

# Background briefing on eco-efficiency

This is a briefing paper, designed to give a comprehensive overview of key issues associated with eco-efficiency, and equip professionals with the information they require to adopt eco-efficient practices.

# Introduction: How to use this briefing

There is an increasing amount of material available on sustainable development and eco-efficiency in the form of conferences, newspaper articles, books and training. It can be difficult to wade through this material and extract the relevant information for employees. This background briefing therefore tries to distill the key points in an informative and useful manner.

It can be used in a variety of situations and shared at different levels of detail, depending on the application and audience. The applications include:

- briefing the facilitator, trainer or presenter on eco-efficiency
- extracting information on particular topics to use as handouts
- sending to participants as pre- or post-training reading materials, and
- posting on the sustainable development intranet or website.

The material can be customized to your company situation – for example by incorporating company case studies or quotes to link back to your own core business.

Eco-efficient specialists may need more detailed information. We have provided references and suggestions at the end of this module, in the section *Resources for eco-efficiency.*

### The WBCSD and eco-efficiency

Eco-efficiency is a management strategy that links financial and environmental performance to create more value with less ecological impact. The WBCSD has been advocating eco-efficiency ever since we first coined the term in 1991.

The WBCSD has worked in recent years to make eco-efficiency more user-friendly for business. The maxim "only what gets measured gets done" highlights a problem that we have tackled by developing a framework for measuring eco-efficiency. To spread the word on what works, we have gathered case studies on eco-efficiency from all over the world and published them in print and on the web.

More than a decade after the Rio Earth Summit, the good news is that eco-efficiency is working in the companies that try it. The troubling news is that it is not being tried on a large enough scale, even though it makes good business sense. We will keep pushing for eco-efficiency, since the future belongs to any strategy that simultaneously increases efficiency, reduces pollution, and improves profitability.

This briefing draws heavily on the work of the WBCSD and in particular two publications: Holliday, C., Schmidheiny, S. and Watts, P., *Walking the Talk: The Business Case for Sustainable Development*, Greenleaf Publishing, 2002, and *Eco-efficiency: Creating More Value with Less Impact*, Geneva: WBCSD, 2000.

# 1.0
# What is eco-efficiency?

At a basic level, eco-efficiency means, "doing more with less". It is a management strategy that combines environmental and economic performance. It enables more efficient production processes and the creation of better products and services while reducing resource use, waste, and pollution along the entire value chain. It creates more value with less impact by unlinking goods and services from the use of nature. Not only can it save production costs but can also open up new sources of revenue for companies.

These are a few succinct definitions of the concept:

- The WBCSD defines eco-efficiency as being "achieved by the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle, to a level at least in line with the Earth's estimated carrying capacity."
- The OECD has called eco-efficiency "the efficiency with which ecological resources are used to meet human needs" and defines it as a ratio of an output (the value of products and services produced by a firm, sector, or economy as a whole) divided by the input (the sum of environmental pressures generated by the firm, the sector, or the economy).
- Academic experts and practitioners term eco-efficiency the synthesis of "economic and environmental efficiency in parallel".
- The European Environment Agency (EEA) defines it as "more welfare from less nature" and says it comes through decoupling resource use and pollutant release from economic development and overall welfare (see Figure 1).

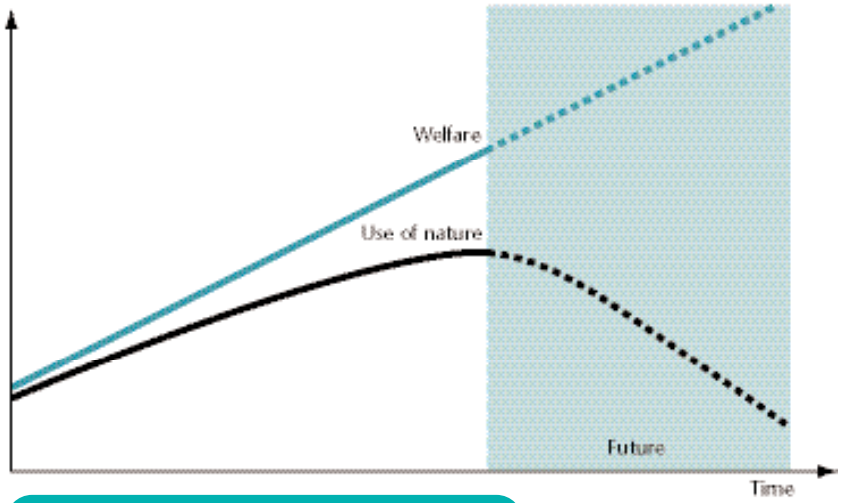



Figure 1: More welfare from less nature

# 2.0
# Key drivers timeline

Although the term "eco-efficiency" has been in use for more than a decade, it has only been embraced by the wider business community in the past couple of years. How did this happen? To what degree did the regulatory environment push business towards more efficient practices? Did companies respond to customer needs or recognize the competitive advantages in an eco-efficient approach? Or does sustainability simply make sense? The following timeline identifies key events and drivers towards the emergence, acceptance, and implementation of eco-efficiency.

1962–1970s–1972–1962

### 1962 Silent Spring

Publication of Rachel Carson's inflammatory book on the chemical industry, which highlighted important questions about humankind's impact on nature. This book raised awareness of the role of business and provided a launch pad for the environmental movement.

### 1972 Limits to Growth

This publication issued a stark warning that economic growth was using up resources at an unsustainable rate and the limits to growth of the planet would be reached within the next 100 years. Challenging conventional wisdom of the time, the Club of Rome predicted this would result in a sudden and uncontrollable decline in both population and industrial capacity. While the study was highly criticized, it nonetheless initiated serious dialogue on the Earth's carrying capacity and highlighted the possibility to alter these growth trends in order to establish a condition of ecological and economic stability that is sustainable far into the future.

### 1970s Pollution prevention

Pollution prevention shifted emphasis from "controlling" pollution once it has been created to "preventing" its creation in the first place. The US manufacturer 3M was instrumental in developing the concept with its "Pollution Prevention Pays", a program implemented in 1975 to eliminate pollution at source. They achieved more than $800 million in cumulative first-year savings.

### 1972 UN Conference on the Human Environment

Leaders from industrialized and developing nations convened at the UN Conference on the Human Environment in Stockholm, Sweden, in order to delineate the "rights" to a healthy and productive environment. At that time the focus for companies was largely on environmental protection by complying with legislation.

1980s — 1987 — 1989 — 1991 — 1990s

### 1980s Environmental movement

The environmental movement grew as consumers became more conscious of the environmental impacts of the products they were buying. In 1984, a poison gas leak occurred at a Union Carbide pesticide factory in Bhopal, India, and the roles and responsibilities of business were questioned by society.

### 1987 The Bruntland Report, Our Common Future

This seminal report from the World Commission on Environment and Development examined the world's environmental and development challenges and how to solve them. A call to action, the book prescribed interaction between governments and the need for a common approach.

### 1989 Cleaner production

The United Nations Environment Programme (UNEP) formalized the concept of cleaner production, and defined it as "the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risks to humans and the environment".

This focus became somewhat more proactive as business embraced the concept of pollution prevention via cleaner production, not necessarily regulation-driven control. Governments began to work more cooperatively with companies rather than by command-and-control regulation.

### 1991 The WBCSD

The Business Council for Sustainable Development (BCSD) – now the WBCSD – first used the term eco-efficiency in 1991. This concept established the link between environmental performance and economic benefits. Stephan Schmidheiny and the BCSD took the concept worldwide through a publication entitled *Changing Course*. Having coined the phrase eco-efficiency, the WBCSD went on to host a number of dialogues, workshops and publications.

### 1990s Setting eco-efficiency targets

The limited physical carrying capacity of the Earth became more accepted with clear targets, and more concrete solutions: eco-efficiency and innovation as tools to unlink economic growth from physical growth.

The Factor 10 Club, as an international body of senior government, non-government, industry, and academic leaders called for the adoption of a factor ten increase in energy and resource productivity in developed countries, while reducing the total use of natural resources globally. It asked for an absolute unlinking of economic growth from the use of natural resources.

2002 – 1998 – 1992

### 1992 UN Conference on Environment and Development, Rio

Heads of state met for the first international Earth Summit to address urgent problems of environmental protection and socio-economic development. Agenda 21, a plan for achieving sustainable development in the 21st century, was adopted.

The term "sustainable development" reflected increasing focus on the development agenda and was embraced through the work of the World Commission on Environment and Development (*Our Common Future* in 1987). In addition to eco-efficiency, companies began to address corporate social responsibility (CSR) and how company operations affect society in general.

### 1998 Factor four

"Factor four" was introduced in 1998 by the Rocky Mountain Institute. It refers to a hypothetical fourfold increase in "resource productivity", brought about by simultaneously doubling wealth and halving resource consumption. It goes on to illustrate technologies that can deliver the necessary improvements.

### 2002 World Summit

The full implementation of Agenda 21, the Programme for Further Implementation of Agenda 21 and the Commitments to the Rio principles, were reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002.

# 3.0
# The business case

The business rationale for eco-efficiency is straightforward: it makes good business sense. Eco-efficiency improves business and environmental performance, and helps companies get out in front of market and regulatory trends, to reduce costs, to gain competitive advantage and to ensure long-term profitability and sustainability. Being efficient is always a high priority for every company. But if it includes creating economic value and reducing environmental impact and resource use at the same time, the value added becomes even more significant. The business case for eco-efficiency applies to every area of activity within a company – from eliminating risks and finding additional savings to identifying new market opportunities.

Five aspects of eco-efficiency have been identified that make it an indispensable strategic element in business (see Figure 2).

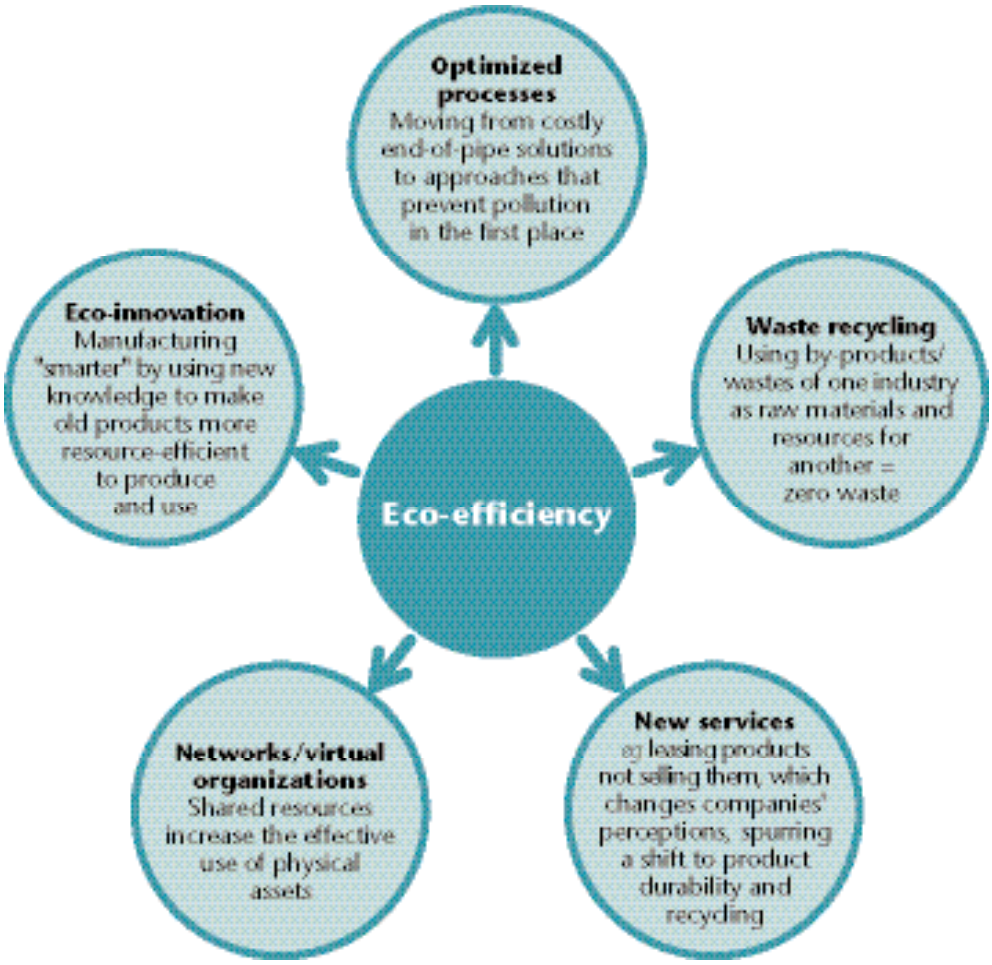



Figure 2: The business case for eco-efficiency

## The benefits of scaling up eco-efficiency

Scaling up eco-efficiency needs people who fully understand the concept and its potential. It should not be limited simply to making incremental efficiency improvements in existing practices and habits. Rather, it should stimulate creativity and innovation in the search for new ways of doing things. Second, it is not limited to areas within a company's boundaries, such as manufacturing and plant management, but is just as valid for the entire supply and consumption production value-chains.

Eco-efficiency's flexibility makes it useful to all companies through changing times. The needs of customers change, and so does their understanding of the environment and the extent of eco-capacity. New risks emerge, such as climate change, and existing ones become better characterized. The continuing pressure of economic and population growth means that some challenges – such as the availability of clean water – become increasingly serious. That is all the more reason to focus on eco-efficiency as a journey rather than a destination, a process rather than a panacea.[1]

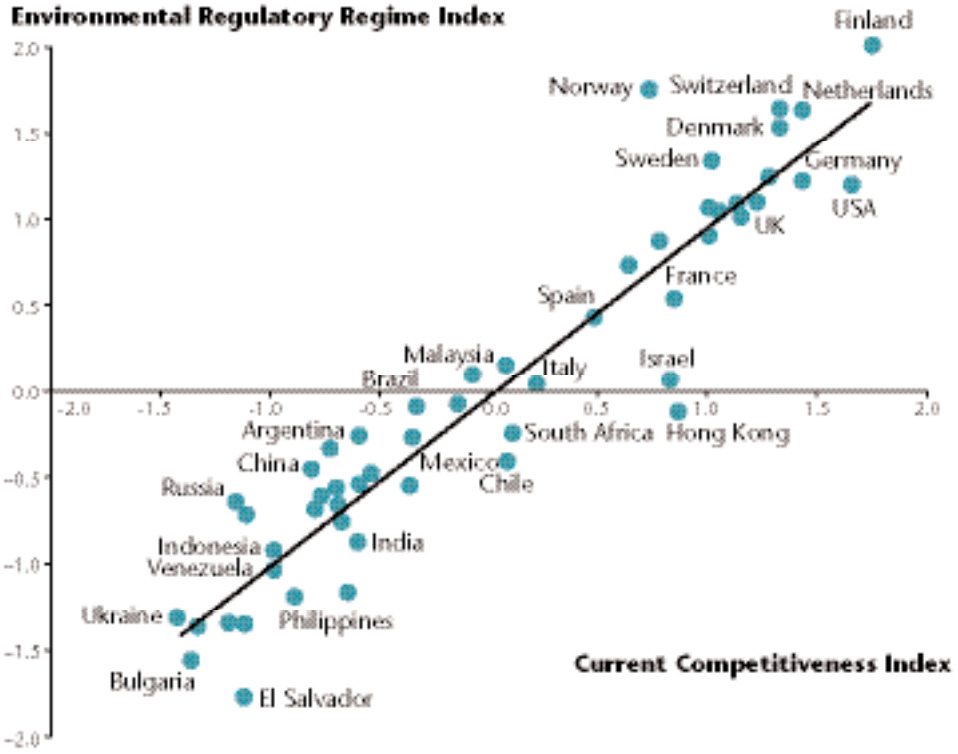
## Competitive advantage

Financial markets have also started to look at aspects of environmental performance. Forward-looking analysts are selecting sustainability leaders because they recognize that companies which have implemented eco-efficiency as a business concept outperform their competitors significantly.

From a macroeconomic perspective, eco-efficiency helps wealthier countries to grow more qualitatively than quantitatively – providing more service, function, and value, not transforming more materials into energy and waste. Eco-efficiency also allows developing countries to continue to grow quantitatively, but with more efficient resource consumption and environmental impact. Given that the concept is about producing more with less (as well as decreasing pollution), then poor countries stand to benefit greatly, especially poor countries where feedstocks such as oil are expensive and some natural resources, such as wood and water, are already in short supply. In fact, improving efficiency of operations may be the only way in which many developing world companies can compete in the global market.

[1] DeSimone, L. and Popoff, F., *Eco-Efficiency: The Business Link to Sustainable Development,* Boston: The MIT Press, 1997

Figure 3 illustrates that countries with stronger environmental regulatory regimes are more competitive in general. This dispels the theory that there is a "race to the bottom", i.e. investment will flow to countries where environmental standards are less rigid.




Source: Esty, D.C. and Porter, M.E., "Measuring National Environmental Performance and its Determinants", *The Global Competitiveness Report 2000*, Geneva: World Economic Forum

Figure 3: Environmental regulation and competitiveness

# 4.0
# Implementing eco-efficiency

Eco-efficiency can be implemented along the entire value chain of a product or service, not just within the physical boundaries of the plant. For some companies, the main harmful effects on the environment with which they are associated actually occur outside their fences – either upstream in the raw material generation and supplier processing phases, or downstream in the product use or disposal phases. In light of this, eco-efficiency can be achieved through seven key approaches:

**R**educe material intensity
**E**nergy intensity minimized
**D**ispersion of toxic substances is reduced
**U**ndertake recycling
**C**apitalize on use of renewables
**E**xtend product durability
**S**ervice intensity is increased.

Figure 4 illustrates the four major areas that provide opportunities for increased eco-efficiency. It can help companies to identify where the opportunities can be found and who, inside and outside the company, will be involved in exploiting them.

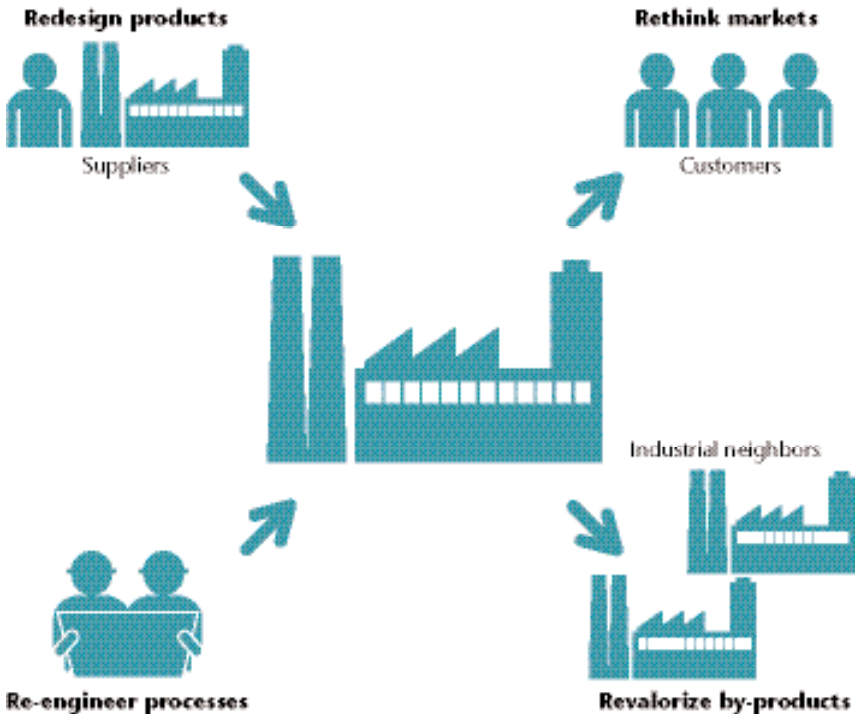



Figure 4: The four areas of opportunity for eco-efficiency

**Opportunities to: Re-engineer processes**

- Optimize processes and procedures to minimize resources (materials, time, etc.)
- Maximize energy and water savings
- Eliminate hazards where possible
- Save through systematic risk minimization
- In production, procurement, sales, R&D, human resources, etc.

**Revalorize by-products**

- New revenue sources from "waste" products
- Cheaper resources from optimal by-products from others
- Maximize use of purchased virgin resources
- Benefits from cooperation with other companies

**Redesign products**

- Consider entire value chain in product design – supply chain through disposal
- Make products upgradeable and recyclable
- Create new and increased functionality

**Rethink markets**

- Know the customer
- Sell functional (rather than material) offerings
- Provide users with comprehensive solutions
- Create new businesses with add-on services
- Improve customers' eco-efficiency
- Rethink opportunities in light of changing market conditions (new taxes, increased consumer awareness, etc.)

As Figure 4 makes clear, all departments within a company can contribute to increasing eco-efficiency: operations, procurement, R&D, sales, marketing and management all have their part to play. Many companies, recognizing this, have made eco-efficiency part of their overall business strategy. They have realized that key eco-efficient opportunities lie not just in their manufacturing, but also along the entire supply chain as well as in the use of their product and services. Eco-efficiency for them has become a major driver of innovation and progress, a vehicle that helps them meet their economic and environmental targets.

The WBCSD believes that it is of vital importance that top management buy into the concept of eco-efficiency. Those corporations where eco-efficiency is on the CEO's agenda have been able to make real progress. Their performance is not limited to a few incremental improvements in specified aspects. Instead, they begin to leapfrog eco-efficiency with innovative products, new services and a focussed business strategy toward sustainability.

# The eco-efficiency tool box

Implementing eco-efficiency along the entire value chain of a product or service entails various techniques and tools. Each tool in the eco-efficiency tool box continues to evolve.

Eco-efficiency can be understood as a way of thinking (e.g. how do I conduct business in an economically and environmentally efficient way?) and a management tool (e.g. systematically applying the seven elements to business decision making will improve my eco-efficiency). Implementation of eco-efficiency can range from simple and somewhat standard industrial practices related to improving resource and energy efficiency to highly innovative product and process redesign initiatives, in which ecological or environmental considerations are used as a catalyst for change. To support this range of applications there are many tools available. Below, we have highlighted a few of those most commonly used.

**Environmental Management System (EMS)**

An EMS is defined as the organizational structure, responsibilities, practices, procedures, processes, and resources for implementing and managing an organization's environmental affairs while ensuring conformity to its policies, standards, and stakeholders' expectations. An EMS can help identify where eco-efficiency opportunities occur within a company.

**Life-Cycle Management**

The Society of Toxicology and Chemistry's Life-Cycle Management Working Group has defined life-cycle management as "a flexible integrated framework of concepts, techniques and procedures to address environmental, economic, technological and social aspects of products and organizations to achieve continuous environmental improvement from a life-cycle perspective". LCM can help organizations integrate or hardwire eco-efficiency into business decision-making.

**Life-Cycle Assessment**

Life-Cycle Assessment is a decision-making tool to identify environmental burdens and evaluate the environmental consequences of a product, process or service over its life-cycle from cradle to grave or cradle to cradle in the case of products that can be recovered and recycled or reused. By providing a system-wide view of a product, LCA is helping industry, governments and research institutes determine the ways to optimize the eco-efficiency of an entire product system as opposed to just a particular facility or process.

**Eco-Innovation, Design for Environment (DfE) or Eco-design**

The integration of environmental considerations into product and process design. Fundamental to DfE is the use of tools and practices that encourage environmental responsibility and simultaneously reduce costs, promote competitiveness and enhance innovation. Design for Environment (DfE) or Eco-design helps organizations integrate eco-efficiency right where it is most needed – at the conceptual planning and design stage.

**Environmental Supply Chain Management**

Supply chain management (SCM) is the organization of activities to address the performance of material, components, goods and services that an organization buys and uses. There is a growing trend toward increasing environmental performance requirements down the supply chain from product manufacturers. ESCM can help organizations identify eco-efficiency opportunities in their supply chain.

**Cleaner Production**

UNEP defines Cleaner Production as the continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risk for humans and the environment. In many ways Cleaner Production is about operationalizing eco-efficiency at the process level (i.e. by conserving raw materials and energy, eliminating toxic raw materials and reducing the quantity and toxicity of all emissions and wastes before they leave a process) and the product level (i.e. by reducing impacts along the entire life-cycle of the product, from raw material extraction to the ultimate disposal of the product).

There are numerous other tools and approaches being used to support eco-efficiency. They include life-cycle costing, industrial ecology, green procurement, pollution prevention and others. In general all of these tools strive to reduce the environmental impacts of companies, and their products or services while simultaneously improving financial performance. The choice of which tools an organization uses depends on a number of factors including their own internal policies and capacity, the nature of their interactions with the natural environment, the degree of control they have over product design and supply chains (e.g. a company that does not design products will have little use for eco-design) and their particular market and regulatory drivers.

Sources: Five Winds International, *Eco-Efficiency: Global Challenges and Opportunities in the 21st Century: Part 1 Overview and Analysis*, 2000
Pollution Probe and Five Winds International, *Policy Framework for Environmental Sustainability Project: Summary Report*, 2004

# 5.0
# Measuring eco-efficiency

"The old maxim 'Only what gets measured gets done' is as true in this case as anywhere else," says Markus Lehni, director of Global Sustainability Services at management consultancy Deloitte & Touche. "Setting targets and measuring progress is very important, both internally and externally. With good metrics, we can better demonstrate how these things are connected environmentally and economically."[1]

Companies may choose to measure their eco-efficiency performance for many different reasons – for example:

- to track and document performance and progress
- to identify and prioritize opportunities for improvement, and
- to identify cost savings and other benefits related to eco-efficiency.

A company may also want to demonstrate why improvement is limited in certain areas or will not be possible to the degree expected by certain stakeholders.

Eco-efficiency indicators also help managers make decisions on a product or business portfolio. They can provide managers with the information on how to make a business portfolio more eco-efficient or more sustainable overall – and usually more profitable as well. Monitoring and reporting eco-efficiency publicly is a way to communicate a key element of a corporation's progress on sustainable development to external audiences, including investors, insurers, consumers, and other interested groups.[2]

## Choosing the indicators

Essentially, progress in eco-efficiency can be achieved by providing more value per unit of environmental influence or unit of resource consumed:

$$\frac{\text{product or service value}}{\text{environmental influence}}$$

Using this basic equation, companies can calculate eco-efficiency in a number of ways. The choice of indicators will depend on the needs of individual decision makers:

- A plant manager may wish to focus on the number of products shipped per kilojoule of energy consumed during manufacturing.
- A financial analyst may instead focus on the economic value of products sold per kilojoule.

[1] Markus Lehni, personal communication, September 2001
[2] Verfaillie, H.A. and Bidwell, R., *Measuring Eco-Efficiency: A guide to reporting company performance,* Geneva: WBCSD, 2000

Value and environmental influence can also be measured for different entities, such as production lines, manufacturing sites, or entire corporations, as well as for single products, market segments, or entire economies.[3]

## The WBCSD framework for eco-efficiency information

Lehni points out that the numbers themselves are not sufficient to make the eco-efficiency case: "These figures need interpretation, comparisons with other companies in the same sector, and benchmarks. All of this creates credibility among investors and stakeholders."

The WBCSD therefore has developed a common framework for eco-efficiency indicators, with terminology consistent with the ISO 14000 series and the Global Reporting Initiative (GRI). They define three levels of organization for eco-efficiency information – categories, aspects and indicators.

- **Categories** are broad areas of environmental influence or business value. Each has a number of aspects, which are general types of information related to a specific category.
- **Aspects** describe what is to be measured.
- **Indicators** are the specific measures of an individual aspect that can be used to track and demonstrate performance. A given aspect may have several indicators.[4]

The following shows the three categories identified and their main related aspects.

| Product or service value | Environmental influence in product or service creation | Environmental influence in product or service use |
|---|---|---|
| • volume/mass<br>• monetary<br>• function | • energy consumption<br>• materials consumption<br>• natural resources consumption<br>• unintended events<br>• non-product output | • product/service characteristics<br>• packaging waste<br>• energy consumption<br>• emissions during use/disposal |

All three categories of eco-information must be:

- scientifically supportable
- environmentally relevant
- accurate, and
- useful for all kinds of businesses around the globe.

[3] Verfaillie, H.A. and Bidwell, R., *Measuring Eco-Efficiency: A guide to reporting company performance,* Geneva: WBCSD, 2000

[4] For a full list of categories, aspects and indicators, see Verfaillie, H.A. and Bidwell, R., *Measuring Eco-Efficiency: A guide to reporting company performance,* Geneva: WBCSD, 2000

## Defining general and business-specific indicators

The ultimate aim is to improve the business performance and monitor it with measures that are transparent and verifiable, and therefore meaningful to business managers as well as to external stakeholders. While the emphasis is on areas under direct management control, we also recognize there are relevant issues upstream (e.g. with suppliers) and downstream (e.g. in product use) of a company's activities.

**Generally applicable** indicators can be used by virtually all businesses. As well as being more or less universally relevant, each of these indicators relates to a global environmental concern or business value and methods for measurement are established and definitions accepted globally.

All other indicators, which do not meet these criteria, have been termed **business-specific**, meaning that they are more likely to be individually defined from one business or one sector to another. These indicators are not necessarily less important than the first group. That judgment will depend on the nature of an individual business. They are merely less widely applicable. A company's eco-efficiency performance profile will include both types of indicators.

The indicators fall into two groups, based on the eco-efficiency formula which brings together the two eco-dimensions of economy and ecology to relate **product or service value** to **environmental influence**.

The generally applicable indicators for **product or service value** are:

- quantity of goods or services produced or provided to customers, and
- net sales.

Those relating to the **environmental influence** in product or service creation are:

- energy consumption
- materials consumption
- water consumption
- greenhouse gas emissions, and
- ozone-depleting substance emissions.

While the environmental influence of products or services in use is important, we have not identified any generally applicable indicators for this category of eco-efficiency. All indicators in this group are considered to be business- or product-specific.

The following additional indicators could become generally applicable if current efforts to develop global agreement on measurement methods are successful:

- additional financial value indicators
- acidification emissions to air, and
- total waste.

### Limiting the number of generally applicable indicators

However, a small number of generally applicable indicators is helpful in assessing companies' eco-efficiency because a proliferation of measures would make it difficult for reports to be clear and understandable, especially externally. A small core of common indicators will help learning and comparability across time, sectors and industries.

At the same time, individual companies should develop a fuller description of their performance by adding business-specific indicators.

# 6.0
# Reporting on eco-efficiency

There are important practical issues for preparing a company's eco-efficiency profile and reporting internally and to external stakeholders. These include selecting boundaries for the data, where to find data and how to compile it appropriately, taking account of sensitivity, error and problems of transformation and conversion.

It is important that companies provide some perspective on issues such as the scope and limitations of their indicators, so that users understand the nature of the information provided.

## Data aggregation

The questions of aggregation and benchmarking are particularly important. While aggregation will often be desirable, it may obscure potentially important information about an enterprise's eco-efficiency performance. For example, different types of unrelated emissions, or emissions across different geographic locations, may be added together, preventing a valid assessment of potential influences on the environment. Similarly, eco-efficiency estimates from different products, processes, or geographic areas may be combined and averaged, obscuring details about the performance of individual units.

Aggregation must therefore be done with care, and transparently, so that the limitations of the information can be properly understood. This is especially the case when data is reported publicly and comparisons are made between different companies, processes, or products.

## Taking account of diversity and change

Outside users of eco-efficiency information are likely to want to make comparisons between companies and over time – but it is important to recognize the inherent diversity of business and the particular circumstances of individual companies.

Comparisons should be made only when the companies being compared provide the same product or service. It is also important to recognize that the product portfolios of different businesses often change, and that this may affect eco-efficiency figures regardless of a firm's environmental efforts. The impact of such changes should be explained by companies in reporting eco-efficiency data, to allow users to interpret reports accurately. The corollary of this is that companies can use eco-efficiency information to develop their product mix and activity toward a more eco-efficient portfolio.

## Reporting the trends

Trend data is important so that changes in performance over time or compared to a reference point can be assessed. Data can be presented as absolute figures, eco-efficiency ratios, indexed to a selected year, or expressed relative to a projected goal. Performance can also be expressed relative to an industry average, if that is available.

If indices are used, however, the absolute numbers underlying them should also be published so that users can calculate their own ratios. It is crucial that data presented in such charts be truly comparable so that the trends depicted accurately represent eco-efficiency performance.

## Elements of an eco-efficiency profile

We propose the following five elements for a summary eco-efficiency profile, plus a verification statement if the report has been externally reviewed:

1. **Organization profile** – to provide a context for the eco-efficiency information, including the number of employees, business segments, primary products and major changes in the structure of the company.
2. **Value profile** – indicators from the "value" portion of the WBCSD framework, including financial information, the quantity of products, or functional indicators for specific products.
3. **Environmental profile** – including generally applicable environmental influence indicators as well as business-specific indicators relating to product or service creation and use.
4. **Eco-efficiency ratios** – in addition to providing in the previous two elements the basic "numerator" and "denominator" data for estimating eco-efficiency, companies may also wish to provide calculations of eco-efficiency indicators that they consider most relevant and meaningful for their business.
5. **Methodological information** – covering the approach used to select indicators, data collection methodologies, and any limitations on use of the data.

## Integration into the business processes

The WBCSD recommends that companies integrate eco-efficiency information into their overall decision-making and communications processes. Internally, it should be part of routine management systems. Externally, eco-efficiency indicators could be provided in corporate environment or sustainability reports as one of the integrating elements between the three pillars of sustainability, and could be included in existing financial reports as an extension to pure financial reporting.

# 7.0
# Eco-efficiency and governments

Eco-efficiency works in companies that try it; that is the good news. The more troubling news is that eco-efficiency is not yet being tried on a scale that truly makes a difference in the way most business is conducted today – or at a pace that will significantly stem the tide of damage to the natural environment as populations grow and poor nations develop.

Stepping up efforts in eco-efficiency will require a new contract among society, government, and business. Under it, corporate leaders would pledge to invest in eco-efficient innovation – that is, to achieve radical rather than incremental environmental improvement over the long term, to work to reduce global inequalities, and to be responsible employers and community members.[1]

Governments would agree to establish a framework of regulations, economic instruments and information disclosure to encourage long-term progress and penalize free riders without damaging competition. Policy measures to leverage business initiatives for more eco-efficiency can include elements such as:

- identifying and eliminating perverse subsidies
- internalizing environmental costs
- shifting tax from labor and profit to resource use and pollution
- developing and implementing economic instruments, and
- promoting voluntary initiatives and negotiated agreements.

Governments can use various incentives to promote action toward progress and support initiatives to advance eco-efficiency – rewarding the leading-edge companies and putting pressure on the laggards. Incentives to reward eco-efficiency will guide innovation in the right direction and create new products and services.

### International measurement and comparison

The EEA, established by the European Union in 1990 to serve as the hub of the European Environmental Information and Observation Network (EIONET), has adopted eco-efficiency ratio indicators for countries, asking for an absolute and relative "unlinking of growth of welfare from the use of nature". It intends to measure and compare economic sectors and countries with each other according to their eco-efficiency status and improvements.

[1] DeSimone, L. and Popoff, F., *Eco-Efficiency: The Business Link to Sustainable Development*, Boston: The MIT Press, 1997

The OECD environment ministries in 1996 observed: "A strategy to improve eco-efficiency might enable industry, governments, households to decouple pollutant release and resource use from economic activity" (Figure 5). The OECD investigated the potential of the eco-efficiency concept "in the light of studies suggesting that factor-of-ten efficiency improvements are both necessary and possible in the next 30 years", and recommended the use of eco-efficiency ratios as macro-level indicators.[2]

The OECD identified innovation as the key driver for improving eco-efficiency and said that it was best stimulated by strong competition, regulatory incentives, an effective process of disseminating "best practice", and the presence of a good climate for innovation.

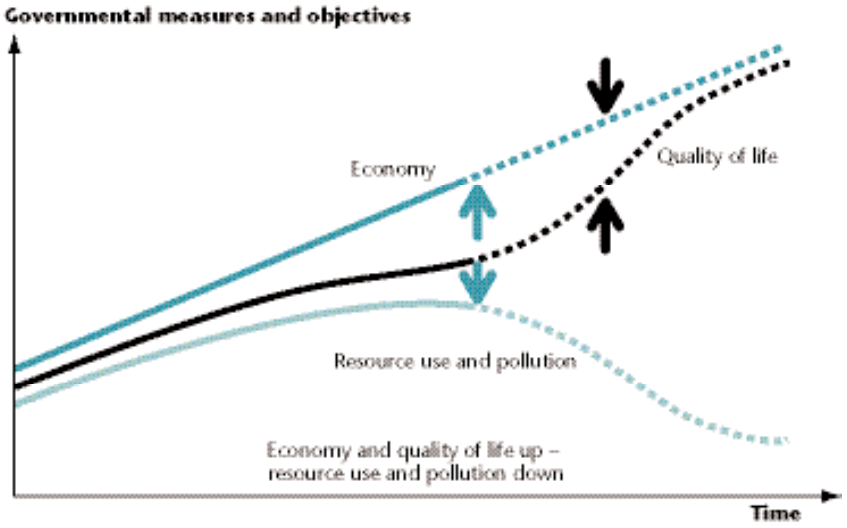



Figure 5: Decoupling economic growth from resource use and pollution

[2] *Eco-Efficiency: Creating More Value with Less Impact,* Geneva: WBCSD, August 2000

## The need for leadership

What is needed now are radical improvements, better product design, and further adoption of eco-efficient principles by small and medium-sized enterprises, which comprise the majority of industry in most countries. This calls for greater leadership by business, governments, and civil society, further refining of targets and metrics, and continuous improvement. It will also mean overcoming barriers to further expansion of eco-efficiency, including the absence of the right market signals and insufficient regulatory frameworks.

Despite these obstacles, eco-efficiency has gained enough momentum to redefine the way many leading companies conduct their everyday business and view the world around them. For these companies, dematerialization, closed production loops, service extension, and functional extension have become ways of doing business more profitably.

The move from a supply-driven to a demand-driven economy is also prompting companies to rethink how they can satisfy demand by creating customized responses to client needs or manufacturing products with new and enhanced functionality.

# 8.0
# Getting to small and medium-sized enterprises

Multinational corporations have the staff and the cash flow to research and reap the benefits of eco-efficiency. However, many small and medium-sized enterprises (SMEs) feel they do not have time or money for anything but survival. In practice SMEs can also benefit from eco-efficient activities.

In Latin America, as trade barriers fall, companies must be much more competitive to survive. This is particularly true for the SMEs, which comprise 90% of industrial companies. These firms produce less than half of all industrial output, and a disproportionately high amount of pollution because they are under-regulated and lack the high visibility of bigger companies. Yet Latin American firms compete in a global context where eco-efficiency is integral to leading firms' business strategies. But they also operate within a distinctively Latin American context defined by pressing social needs, fundamental environmental and public health problems, regulations and limited regulatory enforcement, macroeconomic policies that favor environmentally unfriendly practices, and limited environmental infrastructure.[1]

Where cost-savings do not make the case, then SME investment in eco-efficiency depends on the strength of government institutions and market demand. Often, the latter is non-existent. Enterprises in the region lack the local demand for, information about, or sources of finance for, cleaner products. However, these challenges can create opportunities: to benefit from other countries' experiences, to leap-frog technology, to avoid costly mistakes, and to develop an approach to environmental management that takes account of particular cultural needs and capabilities.

## Creating the market for eco-efficiency

At present, there is little market for eco-efficiency and governments are realizing that they must help to create that market. For instance, the cost of becoming certified by an accredited certification authority such as ISO is prohibitive for most SMEs. In many cases, the barrier is more of a management than a technical problem. Environmental problems tend to be generated by a lack of good management in all areas, so such problems cannot be fixed by a technical change here or there.

Some big companies are working with smaller ones so all can benefit from eco-efficiency. Strengthening government institutions and business associations, creating regulations, making the certification process and environmental management systems more widely available, education and training, and more demonstration projects will help create the market.

[1] *Environmental Investment Strategy*, Inter-American Development Bank, Multilateral Investment Fund, www.iadb.org, accessed November 2001

## Improving SME eco-efficiency

Eco-efficiency solutions must be adapted to local conditions, both culturally and economically. This means that working on best practices and good housekeeping often yields greater success than a large technology transfer or the implementation of an Environmental Management System (EMS). The "informality" of many SMEs is another significant barrier to further adoption of eco-efficiency – often they don't pay taxes or obtain water or energy legally which gives them a lower cost structure than a competitor.

A number of steps have been identified for improving SME eco-efficiency:

- SMEs can work with supply chains, neighbor companies, or NGOs to create environmental improvement and generate information that allow SMEs to demonstrate improvements to the market (i.e. ISO 14001).
- Industry and government must generate home country demand by fostering environmental technologies that anticipate market demands and requirements.
- Engage the community and workers. In OECD countries, the availability of public information concerning firm environmental performance, coupled with local community activism, has been a major driver of improved performance.[2]
- Financing institutions and insurers can require improved environmental performance and make assistance available.

A Mexican SME found a major source of savings in reducing its social security payments when it was reclassified as a non-hazardous workplace. Also, companies will be more likely to improve performance if they can meet realistic regulations and are publicly recognized for their efforts.

The necessary infrastructure is another overriding concern. If firms are to segregate and manage hazardous waste, for example, there must be a place to dispose of, recycle, or treat the waste.

Additional steps on the road to eco-efficiency for SMEs include more training and assistance, greater access to information, and the development of low-cost, effective certification systems.[1]

[2] *Environmental Investment Strategy*, Inter-American Development Bank, Multilateral Investment Fund, www.iadb.org, accessed November 2001

# 9.0 Limitations

Eco-efficiency has its critics but this criticism often comes about due to a lack of understanding. William McDonough and Michael Braungart, specialists in architecture and design chemistry, wrote in *The Atlantic Monthly* in 1998 that the concept was "fatally limited". They claimed that eco-efficiency "tells us to restrict industry and curtail growth – to try to limit the creativity and productiveness of humankind". In fact – and this upsets some environmentalists – eco-efficiency sets no limits to growth and no inherent restrictions on industry. It seeks more efficient growth, and in doing so calls for a great deal of "creativity and productiveness" on the part of humankind. The authors' only proposed solution to the perceived problems with eco-efficiency was to change the term to eco-effectiveness![1]

Eco-efficiency is also criticized for not achieving all the goals of sustainable development, as it lacks stated limits and it lacks a social side. However, it was never intended to wrap up the whole concept for business; it was meant to give business a businesslike way into sustainable development. It is a helpful tool, which allows companies to do better business while playing their part in the environmental side of sustainable development. Many companies that have embraced eco-efficiency have also gone on to explore the social aspects of sustainable development.

By itself, eco-efficiency cannot cope with business' harmful effects upon the environment. Economic growth is required to create jobs and opportunities for growing populations and to help people pull themselves out of poverty. One can imagine a world in which companies are increasing their eco-efficiency by 5% a year while industrial output is increasing by 10% a year – and the planet is not becoming a cleaner place to live.

Eco-efficiency is not meant to be an all-inclusive panacea. Indeed, while eco-efficiency is an important step in moving towards more sustainable patterns of production and consumption, it is important to remember that eco-efficiency is:

1. not a take-it-or-leave-it approach; it needs to be integrated in the company systems
2. not a solution to all the obstacles to sustainability, nor an assurance against failure; it is just one part of the puzzle
3. not a rigid framework or a single strategy, but a method to improve practices in compatibility with other corporate strategies
4. not a certifiable standard or a reporting format, but it can contribute towards improving and communicating results
5. not a cook-book with recipes and solutions one can buy off the shelf; it needs company-specific interpretation and implementation.

[1] McDonough, W. and Braungart, M., "The Next Industrial Revolution", *The Atlantic Monthly*, October 1998

# 10.0
# Next steps

Ten years after the World Summit on Sustainable Development in Rio, it is clear that eco-efficiency works, building value for customers and stakeholders. The challenge now is to move away from a compliance-focussed, crisis-avoidance mentality to seeing good environmental and social performance as the essential foundation for the market value and public reputation.

A stronger argument for eco-efficiency needs to be made to service organizations, whose individual environmental impacts are often relatively minor, but account for a large proportion of economic activity in developed economies. Stepping up the pace will mean strengthening the link between eco-efficiency and shareholder value and devising new accounting techniques to enable organizations to assess eco-efficiency in a way that makes sense to the financial community.

Companies that are leading the way to eco-efficiency recognize business' responsibility to provide leadership in embracing eco-efficiency challenges. Business is uniquely placed to understand customer needs and how these can be delivered through much more eco-efficient services and products that create step improvements in environmental performance. Business is also in a position to create the core technologies that are critical to sustainable development and to transfer ideas and technologies around the world. Finally, business can use its marketing skills to inform consumers who may sometimes be unaware of the urgency and requirements of sustainable production and consumption.

## The role of the market

Eco-efficiency is also part of a broader concept – sustainable consumption and production. A holistic approach to the marketplace treats supply and demand as one system rather than separate, independent entities. As such, the market can be a significant force in enhancing sustainability. Business must continue pursuing eco-efficiency and innovation, but must also go beyond this to proactively set up partnerships with governments and non-governmental organizations to bring products and services to meet existing and emerging consumer and societal needs. Business can also contribute to improving market framework conditions, favoring stable, corruption-free socio-economic ones that facilitate positive change. They can provide and inform consumer choice, establish the worth of the Earth's resources, and aim to make the market work for all. These principles are outlined in the WBCSD's publication *Sustainability Through the Market,* published in 2002.

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

LEARNING UNIT A

# Understanding eco-efficiency



Understanding the business case is important to help communicate the value of eco-efficiency. This means understanding where eco-efficiency has emerged from, and what are the key definitions, drivers and trends. The tools in this unit provide an active introduction for people with limited (or no) knowledge of eco-efficiency. They include a warm-up activity, a set of PowerPoint slides and a quiz that will help presenters to assess the current knowledge level of the group.

# 1.0
# Getting started with autographs

**Background**

Good group dynamics can contribute enormously to the success of a workshop. Spending time on introductions can help groups to get to know each other and break down barriers. In the long term, this can contribute to the success of a workshop. Participants also need to know what is going to happen in the workshop, feel safe and included, and trust the facilitator.

**Purpose & learning objectives**

The very simple warm-up activity outlined here will help people to get to know each other quickly. It also provides an opportunity to introduce the theme of the workshop in a relevant and interesting manner.

**Materials**

You need to prepare in advance enough "autograph cards" to give one to each participant. (We have provided two samples – see next page.)

**Facilitating the activity**

At the start of the session:

- Distribute one "autograph card" to each participant.
- Explain to participants that they have just three minutes to collect eight different signatures – one for each question. Only people who can answer positively to the question can sign. Encourage participants to move around the room.
- After three minutes, you can ask for a show of hands on how many people have collected eight different signatures.

From experience, participants tend to interpret the instructions differently; do not be surprised if some collect the same signature for several statements, or many signatures for one statement.

**Variations**

Consider reducing the number of questions on the card, so each participant just has a few different questions with yes and no columns. This will allow everyone to participate and potentially sign.

Use questions as discussion points and link to the rest of the module.

Present an award to the participant who has a signature from every other participant, or comes closest to that.

## AUTOGRAPHS

| | |
|---|---|
| Who recycles their paper? | |
| Who has expert knowledge of eco-efficiency? | |
| Who rides a bicycle? | |
| Who can describe three types of pollution? | |
| Who is good at math? | |
| Who thinks car sharing is a good idea? | |
| Who knows what eco-efficiency means? | |
| Who believes “what gets measured gets done”? | |

## AUTOGRAPHS

| | |
|---|---|
| Who knows the fuel efficiency of their automobile? | |
| Who is concerned for the welfare of the planet? | |
| Who sees opportunity where others see risk? | |
| Who knows the difference between PET, PP and PE*? | |
| Who thinks government could do more to "green" the planet? | |
| Who believes safety is paramount to all activities? | |
| Who turns the lights off when leaving a room? | |
| Who thinks "out-of-the-box"? | |

* (One statement on the cards mentions PET, PP and PE. In this instance, PET stands for polyethyleneterephthalate, PP for polypropene and PE for polyethylene.)

# 2.0
# Presenting the evidence

"The active effort around a lasting development lets enterprises become more competitive, shock resistant and more flexible in a rapidly changing environment and increases their popularity among customers and highly qualified employees."
Kommunalkredit Dexia Asset Management, Sustainability Pays Off: an assessment of stock exchange performance of members of the WBCSD

## Background

In order to implement sustainable development, it is essential to secure buy-in from different layers of an organization: CEO and senior management through to operations and administrative staff.

Presentations are a traditional method of sharing your ideas with a range of audiences. Eco-efficiency, as part of sustainable development, is a new topic and not widely understood so presentations will be a crucial way to introduce employees to the ideas and get them motivated towards action.

## Purpose & learning objective

The PowerPoint slides provided with this module are designed to introduce eco-efficiency issues to people who know little about the subject. The presentation aims to:

- illustrate the characteristics of eco-efficiency and how it has emerged
- demonstrate the evidence and the business case for eco-efficiency.

## Tailoring the presentation for different audiences

The WBCSD PowerPoint presentation can be used for a range of audiences and settings. You may tailor the presentation and delivery to suit the audience. Incorporate situations, examples, questions and current events relevant to your audience, industry sector or location.

The slides may be customised to accommodate your individual company perspectives, balancing global and local issues and concerns.

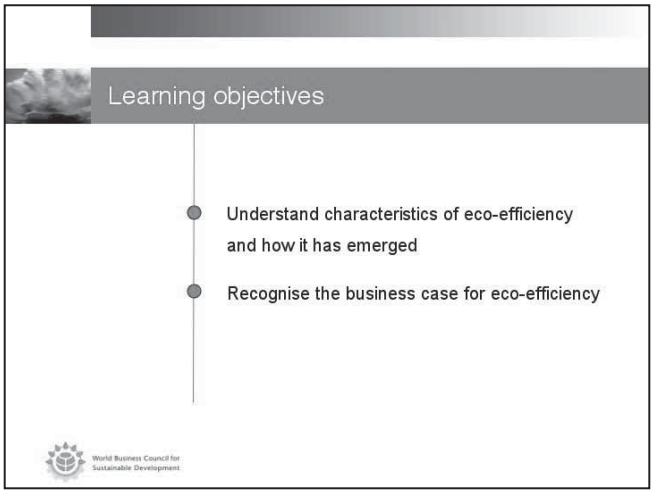
## Delivering the presentation

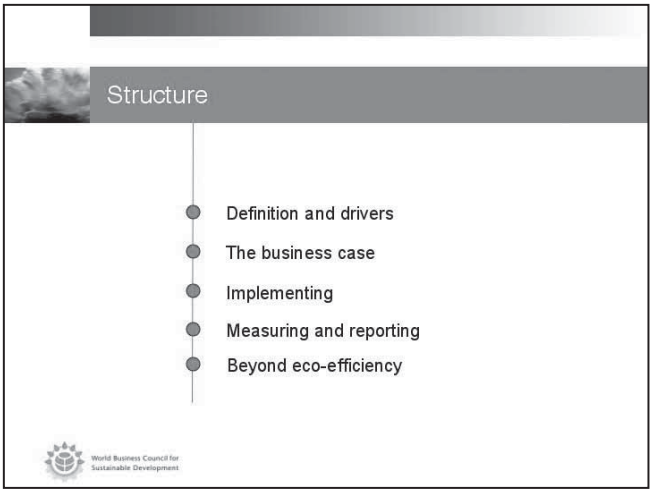
The WBCSD slides are designed to be interesting and engaging. We recommend that you take the time to familiarize yourself with the slides in advance, and prepare notes if necessary. If your current knowledge of eco-efficiency is limited, you will find plenty of source information in the background briefing paper provided with this module. An electronic version of this presentation can be downloaded from the WBCSD's website: www.wbcsd.org.

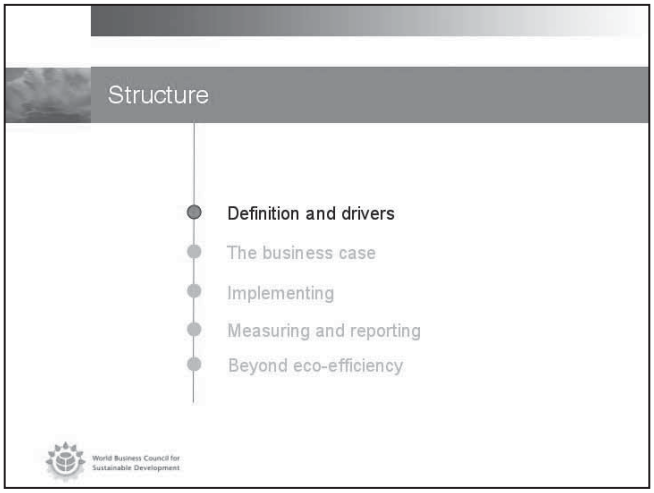
When delivering the presentation try to involve participants as much as possible, to ensure relevance both to the company and to their own life and concerns.

The presentation could take from 20 minutes to an hour, depending on the depth of detail.


DEDICATED TO MAKING A DIFFERENCE
Eco-efficiency
World Business Council for Sustainable Development


Learning objectives
Understand characteristics of eco-efficiency and how it has emerged
Recognise the business case for eco-efficiency
World Business Council for Sustainable Development


Structure
Definition and drivers
The business case
Implementing
Measuring and reporting
Beyond eco-efficiency
World Business Council for Sustainable Development


Structure
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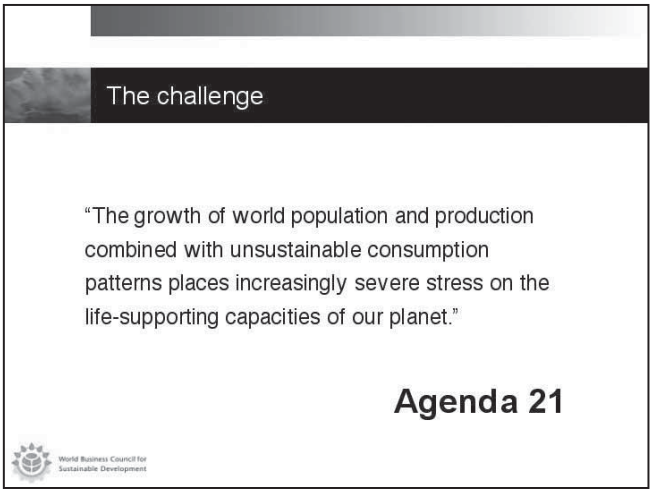

The challenge
"The growth of world population and production combined with unsustainable consumption patterns places increasingly severe stress on the life-supporting capacities of our planet."
Agenda 21
World Business Council for Sustainable Development

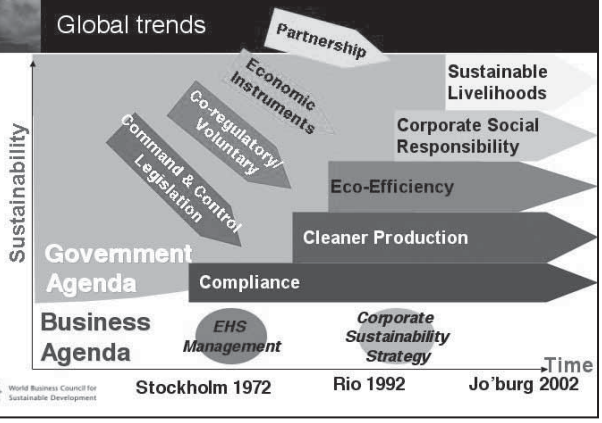

The challenge
To provide more value with less environmental impact
To de-link growth of welfare from the use of nature
To improve both economic and ecological efficiency
= ECO-EFFICIENCY
World Business Council for Sustainable Development

## Definition

"The delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impact and resource intensity throughout the life cycle, to a level at least in line with the Earth's estimated carrying capacity."

## Evolution


## Global trends



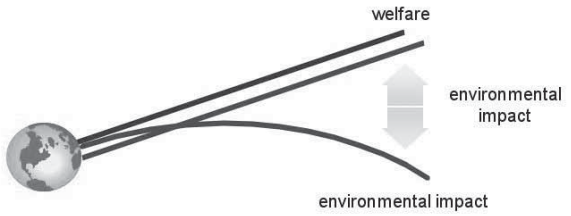

## Why businesses are embracing eco-efficiency

**Because it is a management tool which:**

- focuses on opportunities
- improves performance
- makes businesses more competitive

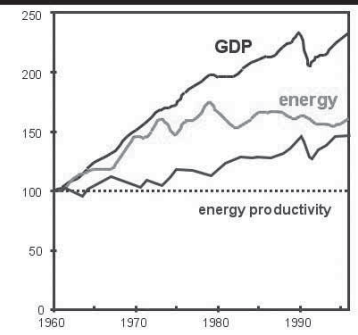
***It speaks the language of business leaders.***

## Why governments are embracing eco-efficiency




***It de-links welfare from use of nature.***

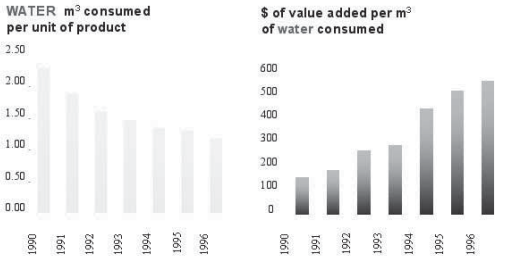
## Energy production: Germany




*index base 1960*

Source - European Environment Agency

## In developing countries too...

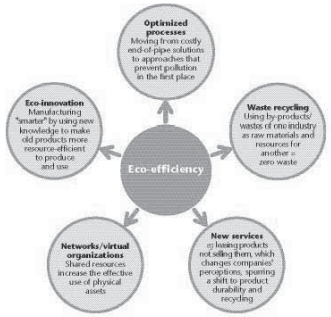



Source – BCSD Colombia

## Structure

- Definition and drivers
- The business case
- Implementing
- Measuring and reporting
- Beyond eco-efficiency

## Business case




## Example: Optimised processes

CEMEX Eco-efficiency Program (CEP)

- Program formally launched in 1994 to leverage experience and innovation in eco-efficiency
- Economic impact of 2000 performance

| | $USM |
|---|---|
| • Optimised materials & natural resource use | 9.2 |
| • Use of alternative fuels & wastes | 4.1 |
| • Reduction of emissions & wastes | 2.2 |
| • Optimised energy use | 19.3 |
| • Office paper recycling | 0.3 |
| • **Total** | **$35.1M** |

- Since 1994 benefits more than $60M
- $CO_2$ emissions reduced by about 2.5M tonnes

## Example: Waste recycling

- Cevolution: new carbon fibers business for ConocoPhillips
  - Working to extend life cycle of crude oil production:
    - Using 'bottom-of-the-barrel' sludge in production of new fibers
      - Sludge previously considered a waste with handling and disposal costs
      - New fibers stronger, lighter and more durable

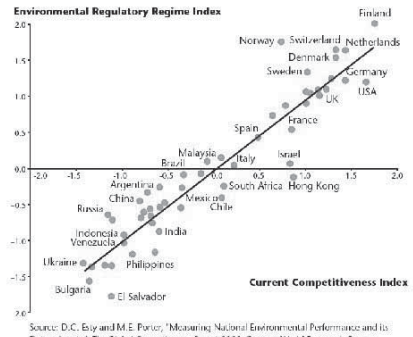
## Example: New services

- Dow Chemical 'leases' chlorinated solvents in a closed-loop system instead of selling them:
  - Offers safe delivery and take-back of solvents
  - Provides customer assistance in product use

## Example: Networks and partnerships

- Testing world's first hydrogen economy:
  - The 3 multinationals are teaming with the Icelandic consortium, Vistorka, to form Icelandic New Energy Ltd (INE). The INE group, comprising business, government and academic institutions, is looking to turn Arnason's dream into a reality and facilitate Iceland's transition from a fossil-based economy to a non-fossil-based economy
  - Idea to make the nation a testing ground for hydrogen vehicles and hydrogen refuelling infrastructure and producing hydrogen using electricity from renewable sources
  - Ultimately aims to make nation energy self-sufficient
  - While achieving Kyoto Protocol goals

## Competitive advantage for nations




Source: D.C. Esty and M.E. Porter, 'Measuring National Environmental Performance and its Determinants,' *The Global Competitiveness Report 2006*, Geneva: World Economic Forum

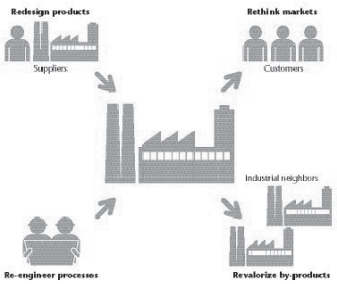
## Structure

- Definition and drivers
- The business case
- **Implementing eco-efficiency**
- Measuring and reporting
- Beyond eco-efficiency

## Explore entire areas within value chain for opportunities

**Market Opportunities**

- Know the customer
- Sell functional (rather than material) offerings
- Provide users with comprehensive solutions
- Create new businesses with add-on services
- Improve customers' eco-efficiency




***Companies can identify business opportunities in eco-efficiency in four different areas.***

## Principle approach

**R**educes material intensity
**E**nergy intensity is minimized
**D**ispersion of toxic substances is reduced
**U**ndertakes recycling
**C**apitalizes on use of renewables
**E**xtends product durability
**S**ervice intensity is increased

## Getting started in your company

- Understand the full life cycle of your products.
- Establish eco-efficiency as a prominent target and evaluation screen in your innovation process.
- Test your key technologies and markets against changing trends in societal acceptance.
- Set eco-efficiency measurements and targets for your current operations and products.
- Develop a communication concept including dialogues, partnerships with stakeholders, and others.
- Evaluate which business lines would benefit from planned resource-based economic instruments.
- Explore how you could mitigate negative impacts through product innovation.

## Structure

- Definition and drivers
- The business case
- Implementing
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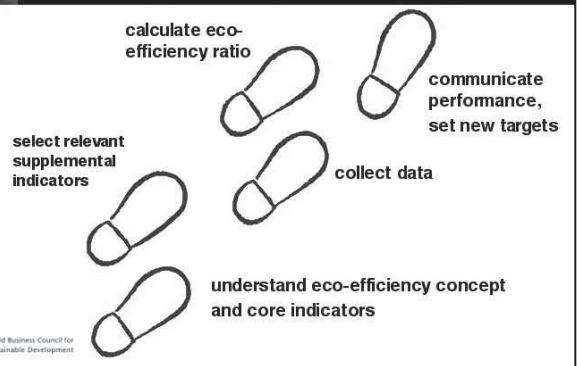
## Steps to measuring and reporting




## Selecting indicators

- be relevant and meaningful with respect to environment, health and welfare
- inform decision making to improve the performance of the organization
- recognize the inherent diversity of business
- support benchmarking and monitoring over time
- be clearly defined, measurable, transparent and verifiable
- be understandable and meaningful to identified stakeholders
- focus on areas under direct management control
- recognize upstream and downstream aspects of a company's activities

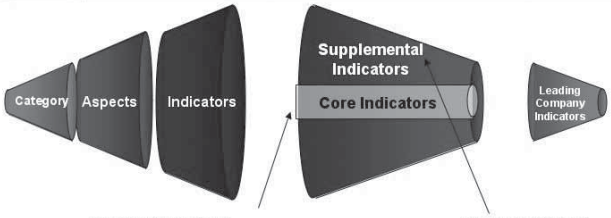
## Eco-efficiency indicators framework


Multiply broad area of environmental influence or business value
*e.g. environmental influence in creation of product*

General information related to category (the "what")
*e.g. material consumption, waste output*

Specific measurement of aspect (the "how")
*e.g. tonnes material consumed, tonnes $CO_2$ emitted*

## Eco-efficiency indicators - framework




Highly relevant and meaningful on global scale to virtually all businesses
*e.g. energy consumption, GHG emissions*

Will look different depending on sector, region, etc.
*e.g. VOC to air, PHM to surface water*

www.sdportal.org

## Calculating the eco-efficiency ratio

- **On the micro-level (company):**

$$\text{Eco-efficiency} = \frac{\text{product/service value}}{\text{environmental influence}}$$

- **On a macro-level (government):**

$$\text{Resource productivity} = \frac{\text{more welfare}}{\text{less resource use}}$$

## Reporting eco-efficiency

Includes five elements:

- Organization Profile
- Value Profile
- Environmental Profile
- Eco-efficiency Ratios
- Methodological Information

$$EE = \frac{\text{product/service value}}{\text{environmental influence}}$$

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## Structure

- Definition and drivers
- The business case
- Implementing
- Measuring and reporting
- Beyond eco-efficiency

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## Action points (1)

| Government leaders & civil servants | Civil society leaders & consumers | Educators |
|---|---|---|
| • Set macro-economic EE targets<br>• Integrate policy measures to strengthen EE (e.g. eliminating subsidies, internalising externalities, effecting shifts in tax policy)<br>• Work toward international policy and systems for trade, financial transactions, etc. for higher productivity, emissions reductions and improvements for underprivileged | • Encourage consumer preference for more eco-efficient products and services<br>• Support political measures to create framework conditions which reward EE | • Include eco-efficiency and sustainability in educational curricula and build into research and development programs |

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## Action points (2)

| Financial markets & investors | Business leaders |
|---|---|
| • Recognize and reward eco-efficiency and sustainability as investment criteria<br>• Help eco-efficient companies to communicate their progress<br>• Promote and use assessment tools and sustainability ratings to support markets and widen understanding of eco-efficiency's benefits | • Integrate eco-efficiency into business strategy, including operational, product innovation and marketing strategies<br>• Report company eco-efficiency and sustainability performance openly to stakeholders<br>• Support policy measures which reward eco-efficiency<br>• Foster eco-efficiency in supply chain, including SMEs |

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## Limitations of eco-efficiency

- Lacks social side
  - Meant as a complementary tool within an SD corporate strategy
- Not a rigid framework or single strategy
- Not a certifiable standard
- Not an off-the-shelf solution
  - A flexible method to improve practices compatible with a variety of corporate strategies
  - Needs company-specific interpretation and implementation

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## Beyond eco-efficiency

1. Innovate
2. Practice eco-efficiency
3. Move from stakeholder dialogues to partnerships for progress
4. Inform consumer choice
5. Improve market framework conditions
6. Establish the worth of Earth
7. Make the market work for everyone

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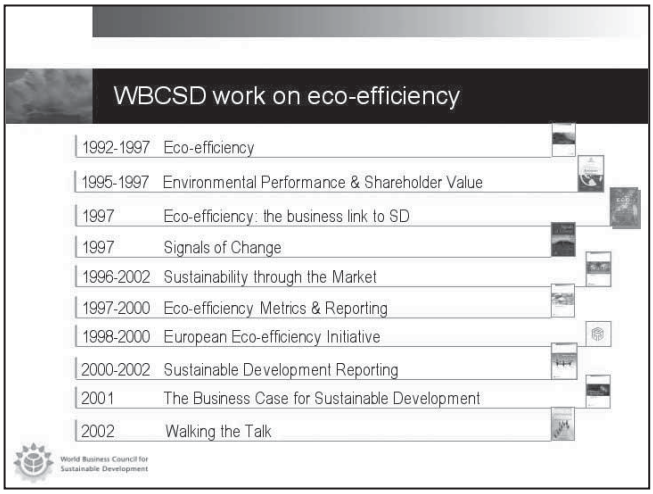
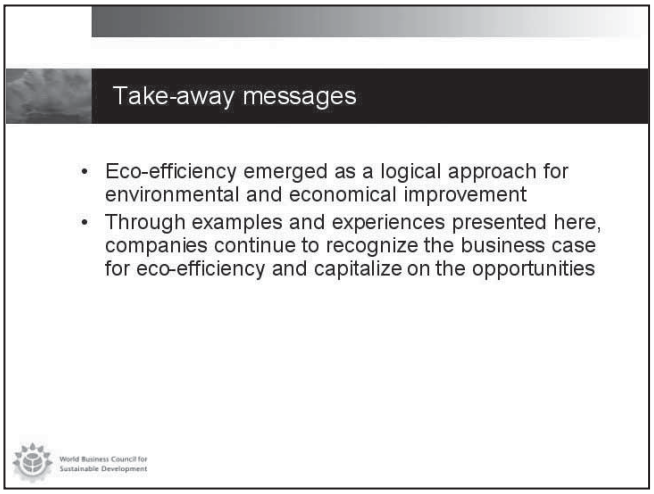

WBCSD work on eco-efficiency
1992-1997 Eco-efficiency
1995-1997 Environmental Performance & Shareholder Value
1997 Eco-efficiency: the business link to SD
1997 Signals of Change
1996-2002 Sustainability through the Market
1997-2000 Eco-efficiency Metrics & Reporting
1998-2000 European Eco-efficiency Initiative
2000-2002 Sustainable Development Reporting
2001 The Business Case for Sustainable Development
2002 Walking the Talk
World Business Council for Sustainable Development


Take-away messages
• Eco-efficiency emerged as a logical approach for environmental and economical improvement
• Through examples and experiences presented here, companies continue to recognize the business case for eco-efficiency and capitalize on the opportunities
World Business Council for Sustainable Development

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 3.0 Understanding the facts

## Background

Eco-efficiency has a scientific basis. Implementing sustainable development involves crossing a range of disciplines and functions, understood in different ways by different stakeholders depending on values, perspectives and experience.

A basic understanding of the issues is necessary in order to bring about change in company practices. Presenting these facts in an interesting and informative way can quickly bring participants to a common understanding and provide a basis for further work.

## Purpose & learning objective

This activity presents a series of quiz questions about basic eco-efficiency definitions, facts and statistics. The facilitator can use the quiz in a variety of ways. Consider using it as an icebreaker or stimulator exercise by splitting the group in two and undertaking the quiz as a competition. It is also an excellent way for the facilitator to assess the skills, knowledge and capabilities of the group.

## Materials

You need to prepare in advance:

- quiz question cards, and
- quiz answers (to be issued for the quiz "debriefing" session).

## Facilitating the activity

At the start of the session, divide the group into teams.

Then either issue the quiz question cards to the participants for them to work on with the others in their team, or read aloud the questions yourself.

Each group must agree one answer to each question. (To avoid individuals providing their own answers, specify that the group must write their answers.)

At the end of the time allowed:

- ask each team for answers and award points for those that are correct, and
- give each participant a copy of the answer handout so the group can discuss the answers, or give verbal answers and feedback.

For questions that ask for a specific percentage consider an answer correct if it is within 5%. If you are asking the questions verbally, you could specify that the nearest percentage guess wins.

## Variations

Be inventive: use a wide range of question styles and formats. Multiple choice is just one approach to asking questions.

Select questions can be added to your presentation to stimulate the group and get them involved. Use the quiz at the end of the workshop to check whether the group has absorbed key information on eco-efficiency.

You can also use the quiz as a follow up or review exercise.

# Eco-efficiency quiz

**Q1** Eco-efficiency opportunities can emerge at any point in the entire life-cycle of product.

True ☐ False ☐

**Q2** Eco-efficiency is a model for maintaining the status quo.

True ☐ False ☐

**Q3** The concept of eco-efficiency was recognized by the WBCSD in:

a) 1972 ☐
b) 1982 ☐
c) 1992 ☐

**Q4** Tighter environmental regulation hinders a country's competitiveness.

True ☐ False ☐

**Q5** The US chemical industry has reduced energy consumption by what percentage per unit of production since 1975?

**Q6** What percentage of worldwide paper production has been recovered for recycling over the past three decades?

**Q7** What are the key drivers for eco-efficient products?

**Q8** In the last decade, by what percentage have worldwide sales of compact fluorescent lamps increased?

# Eco-efficiency quiz

**Q9** What percentage of its steel does the United States recycle?

**Q10** What does LCA stand for?

**Q11** What are the seven approaches of eco-efficiency? (Hint: REDUCES)

**Q12** Automobile use (measured per 1,000 people) increased by 10% in developed countries between 1990 and 1996. By how much did it increase in developing countries?

a) 33% ☐
b) 67% ☐
c) 100% ☐

**Q13** What percentage of urban sewage in the developing world is discharged into rivers, lakes and coastal waterways without any treatment?

a) 40% ☐
b) 70% ☐
c) 90% ☐

**Q14** Over the next five years, tax breaks (loopholes, depletion allowances, reclamation deductions, and other expensing breaks) for the industries having the greatest environmental impact (timber, mining, chemical, oil and gas) will total approximately:

a) $100 million ☐
b) $7 billion ☐
c) Zero ☐
d) Three times the annual EPA budget ☐

# Eco-efficiency quiz

**Q15** The production of goods involves substantial environmental impact such as lost topsoil in agriculture and earth excavation, and mining related to steel and energy production. The amount of such environmental alteration and impact associated with goods production in the US is approximately:

a) Half a ton per capita ☐
b) One ton per capita ☐
c) Two tons per capita ☐
d) 80 tons per capita ☐

**Q16** The raw material that is used in the greatest quantity in the United States today, and which accounts for almost one-third (by weight) of the total raw materials used annually, is steel.

True ☐ False ☐

**Q17** Which of the following practices produces the most organic water pollution?

a) Recreational boating ☐
b) Humans bathing in the water ☐
c) Paper mills ☐
d) Intensive livestock farming ☐

**Q18** Name one economic or other business benefit which would result from making a process or product more eco-efficient.

**Q19** In the Dow Chemical example shown in the slides, the company leased chlorinated solvents, instead of selling them, to customers. What is the business value of this offering? What are the environmental benefits?

# Eco-efficiency quiz

**Q20** Describe an example of eco-efficiency you have observed. Can you identify the business value and the environment benefits?

**Q21** Name some indicators you could use to measure progress towards more eco-efficient practices at your company or in your department.

**Q22** Explain the difference between an "end-of-pipe" approach to managing contaminated wastewater from a facility and a "pollution preventation" approach.

# Eco-efficiency quiz: answers

## A1

True or false? Eco-efficiency opportunities can emerge at any point in the entire life-cycle of a product.

**True,** for example:

- Incremental efficiency improvements in existing practices and habits
- Stimulate creativity and innovation in the search for new ways of doing things
- Can be used for upstream and downstream activities.

## A2

True or false? Eco-efficiency is a model for maintaining the status quo.

**False.** It's a leadership practice aimed at those intending to stay ahead of the curve and meet the future needs of society, natural resource availability and public advantage. It appeals to those who want a competitive and innovative economy.

## A3

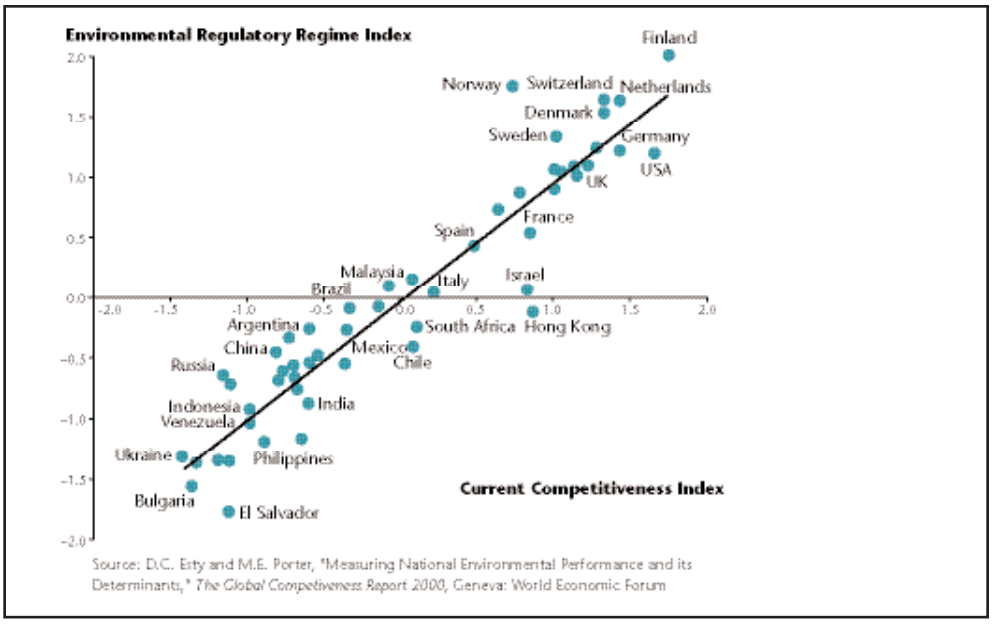
The concept of eco-efficiency was recognized by the WBCSD in: a) 1972, b) 1982, c) 1992.

**c) 1992** – after the Earth Summit, in Rio.

## A4

True or false? Tighter environmental regulation hinders a country's competitiveness.

**False.** This diagram illustrates that countries with stronger environmental regulatory regimes are more competitive in general. This dispels the theory that there is a "race to the bottom", i.e. investment will flow to countries whose environmental standards are less rigid.




Source: Esty, D.C. and Porter, M.E., "Measuring National Environmental Performance and its Determinants", The Global Competitiveness Report 2000, Geneva: World Economic Forum

# Eco-efficiency quiz: answers

**A5** The US chemical industry reduced energy consumption by what percentage per unit of production since 1975?

**43%.**

Source: *Tomorrow's Markets – Global Trends and their Implications for Business,* WRI, UNEP and WBCSD, 2002

**A6** What percentage of worldwide paper production has been recovered for recycling over the past three decades?

**40%.**

Source: *Tomorrow's Markets – Global Trends and their Implications for Business,* WRI, UNEP and WBCSD, 2002

**A7** What are the key drivers for eco-efficient products?

This answer is debatable but elements include: consumer demand, activism, regulations, reduced price, improved performance.

**A8** In the last decade, by what percentage have worldwide sales of compact fluorescent lamps increased?

**1,000% (i.e. ten-fold).**

Source: *Tomorrow's Markets – Global Trends and their Implications for Business,* WRI, UNEP and WBCSD, 2002

**A9** What percentage of its steel does the United States recycle?

**65%.**

**A10** What does LCA stand for?

**Life-cycle analysis.**

# Eco-efficiency quiz: answers

## A11

What are the seven approaches of eco-efficiency? (Hint: REDUCES)

**R**educe material intensity
**E**nergy intensity minimized
**D**ispersion of toxic substances is reduced
**U**ndertake recyclability
**C**apitalize on use of renewables
**E**xtend product durability
**S**ervice intensity is increased

## A12

Automobile use (measured per 1,000 people) increased by 10% in developed countries between 1990 and 1996. By how much did it increase in developing countries? a) 33%, b) 67%, c) 100%.

**b) 67%** – developing countries 15 cars per 1,000 people, developed countries 326 cars per 1,000 people.

Source: *2000–2001 Table ERC.5 "Resource Consumption"*, www.wri.org

## A13

What percentage of urban sewage in the developing world is discharged into rivers, lakes and coastal waterways without any treatment? a) 40%, b) 70%, c) 90%.

**c) 90%.** In cities in the developing world, only 10% of sewage is discharged after treatment. Each year, 2 million children die of diarrheal diseases from contaminated water and another 9 million episodes of illness occur.

Source: *World Development Report (1999),* www.worldbank.org/poverty/quiz/whole.htm

## A14

Over the next five years, tax breaks (loopholes, depletion allowances, reclamation deductions, and other expensing breaks) for the industries having the greatest environmental impact (timber, mining, chemical, oil and gas) will total approximately: a) $100 million, b) $7 billion, c) Zero, d) Three times the annual EPA budget.

**d) Three times the annual EPA budget.** The EPA annual budget is around $7 billion. Annual tax subsidies to the most polluting industries amount to just over $4 billion a year.

Sources: *Estimates of Federal Tax Expenditures for FY 2001–2005; Joint Committee on Taxation, April 2001; Friends of the Earth:* www.foe.org/DSL*; Analytical Perspectives, US Budget, FY 2001*

# Eco-efficiency quiz: answers

**A15** The production of goods involves substantial environmental impact such as lost topsoil in agriculture and earth excavation, and mining related to steel and energy production. The amount of such environmental alteration and impact associated with goods production in the US is: a) Half a ton per capita, b) One ton per capita, c) Two tons per capita, d) 80 tons per capita.

**d) 80 tons per capita.** For instance, about 15 tons of soil are eroded annually in the feeding of one American.

Source: *World Resources Institute, Washington DC, 1997,* www.wri.org/wri/wr-98 99/wasting.htm#matuse

**A16** True or false? The raw material that is used in the greatest quantity in the United States today, and which accounts for almost one-third (by weight) of the total raw materials used annually, is steel.

**False.** Wood is the raw material used in greatest quantity in the US.

The weight of wood used each year is roughly equivalent to the annual consumption of all metals, all plastics and cement combined.

Source: *University of Minnesota,* www.cnr.umn.edu/WPS/cd/evawarequiz.html

**A17** Which of the following practices produces the most organic water pollution? a) Recreational boating, b) Humans bathing in the water, c) Paper mills, d) Intensive livestock farming.

**d) Intensive livestock farming.** Millions of gallons of manure and other animal wastes contaminate our waters yearly.

Source: www.funtrivia.com/submitquiz.cfm

**A18** Name one economic or other business benefit which would result from making a process or product more eco-efficient.

Because eco-efficiency is about generating a given performance or quality with less material and resources, the business benefits can include: reduced energy use and cost of utilities; reduced use of materials and associated handling, storage and disposal costs; reduced emissions and time for tracking and reporting those; improved product performance and customer satisfaction, e.g. with improved product durability, energy efficiency; improved relationships with customers, e.g. helping to support their goals to eliminate toxic substances or recycle product packaging.

# Eco-efficiency quiz: answers

**A19** In the Dow Chemical example shown in the slides, the company leased chlorinated solvents, instead of selling them, to customers. What is the business value of this offering? What are the environmental benefits?

The business value includes a closer, longer-term relationship with the customer, by entering into a service contract. The company does not compete simply on low price of the solvent. It offers its expertise and solves the customer's disposal problem by taking the solvents back. It also interacts with the customer more often. For the environment, few solvents are released to the atmosphere, as they are re-used instead of disposed.

**A20** Describe an example of eco-efficiency you have observed. Can you identify the business value and the environmental benefits?

There is no single correct answer to this question, as it depends on the experience of each person answering.

**A21** Name some indicators you could use to measure progress towards more eco-efficient practices at your company or in your department.

Amount of a particular material input, per unit of saleable output; amount of VOC released to the air each year, or per unit of product sold; percentage of product portfolio qualifying for an eco-logo or environmental label.

**A22** Explain the difference between an "end-of-pipe" approach to managing contaminated wastewater from a facility and a "pollution prevention" approach.

The first approach incorporates technologies to treat contaminates existing in the wastewater and control amounts from entering the environment above regulated limits. The latter approach, pollution prevention, entails identifying what the contaminants are, where they come from and working to keep them from entering the wastewater altogether i.e. substituting a less harmful alternative, innovating a process to eliminate the contaminant, extracting the contaminant and re-using it in the process.

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

LEARNING UNIT B

# Exploring eco-efficiency

There is no agreed solution, pathway or strategy toward eco-efficiency. It is a complex topic that covers a range of disciplines and functions with no obvious "right and wrong". Experience and judgment are central to integrating eco-efficiency issues into business practices and this requires an exploration of the key debates and dilemmas. Exploring eco-efficiency issues and identifying how other companies have dealt with eco-efficiency can help build the necessary skills and experience.

1 Identifying key elements of eco-efficiency
2 Understanding a life-cycle approach
3 Reviewing news stories
4 Debating dilemmas
5 Eco-innovation
6 Negotiating a contract for supply

# 1.0
# Identifying key elements of eco-efficiency

**Background**

Understanding the elements of eco-efficiency can help companies to identify where opportunities can be found, and who – inside and outside the company – will be involved in exploiting them. The WBCSD has defined four key elements of eco-efficiency:

- re-engineer processes
- revalorize by-products
- redesign products, and
- rethink markets.

**Re-engineer processes**

Companies can re-engineer their processes to reduce the consumption of resources, reduce pollution and avoid risks, while at the same time saving costs. Experience shows there are manifold possibilities, some straightforward, some less obvious. Invariably, the whole workforce has to be involved in identifying opportunities and in making the changes necessary to seize them. Process changes may also be related to delivery or to supplier operations, as well as to distribution, customer use or disposal.

**Revalorize by-products**

By cooperating with other companies, many businesses have found creative ways to revalorize their by-products. In striving for zero-waste or 100%-product targets, they have found that the so-called waste from their processes can have value for another company. Sometimes, in the chemical industry for example, by-products have even become a real cash-generating product of a production process. Zero-waste targets and by-product synergies lead to the more effective use of the resources in a process and create an additional cash benefit. In short, they are eco-efficient because they allow the creation of more value with fewer resources.

**Redesign products**

Product designers and procurement managers play a key role in a company. Their influence is not only crucial to product functionality and price. It also has a big effect on the environmental impact of production, product maintenance and disposal. This therefore suggests the third area for eco-efficiency opportunities: companies can become more eco-efficient by redesigning their products. Products designed to ecological design rules can be cheaper to produce and use. They are smaller and simpler in their design. They include a smaller variety of materials and are easier to disassemble for recycling. Often, too, they encompass higher functionality, better serviceability and easier upgradeability. They can provide a higher value for their users, while the environmental influence related to their use is minimized.

**Rethink markets**

Some innovative companies not only redesign a product, they find new ways of meeting customer needs. They work with customers or other stakeholder groups to rethink their markets and reshape demand and supply completely. Too many customers' needs today are met in a material- and energy-intensive way. There are different, and better, ways of satisfying those needs. For example, it is possible that by providing a service instead of selling the product, the overall material or energy intensity may be reduced. This also opens up opportunities for new economic growth and higher profitability.

## Purpose & learning objectives

Tabletop management activities can increase participants' retention of information, can deepen their level of comprehension of the topic, and help them apply the information to their own situations.

The activity outlined here can be used for several different purposes, such as to:

- introduce the four key elements of eco-efficiency
- review the four key elements which have been introduced earlier
- encourage debate on the issue, or
- stimulate thinking beyond the four elements (personal experiences, barriers, implementation, etc.).

## Materials

You need to prepare in advance, for each team of two to six people:

- a set of 16 cards printed with mini case studies and definitions, each identified by a number
- some blank cards in the same format, and
- four cards printed with the four key elements (re-engineer processes, revalorize by-products, redesign products, rethink markets).

We have provided samples of these items on the following pages.

## Facilitating the activity

At the start of the session, divide the group into teams of two to six people.

Give each team a set of mini case study cards and a worksheet (or card) to be completed. The teams then read through the 16 definitions and examples, and place them under the correct key elements card on the table.

When the group – or individual teams – has completed the worksheet, check the answers. The "correct" answers presented on the answer sheet are in fact debatable – and it is worth mentioning that to the participants. Within each group there will likely be debate over where certain cases belong. The activity is designed to encourage discussion.

## Variations

The speed of completion tends to vary from team to team. If you hand out the answer sheets to individual teams as they finish, they can check their own responses and move on to debate without waiting for the slower teams.

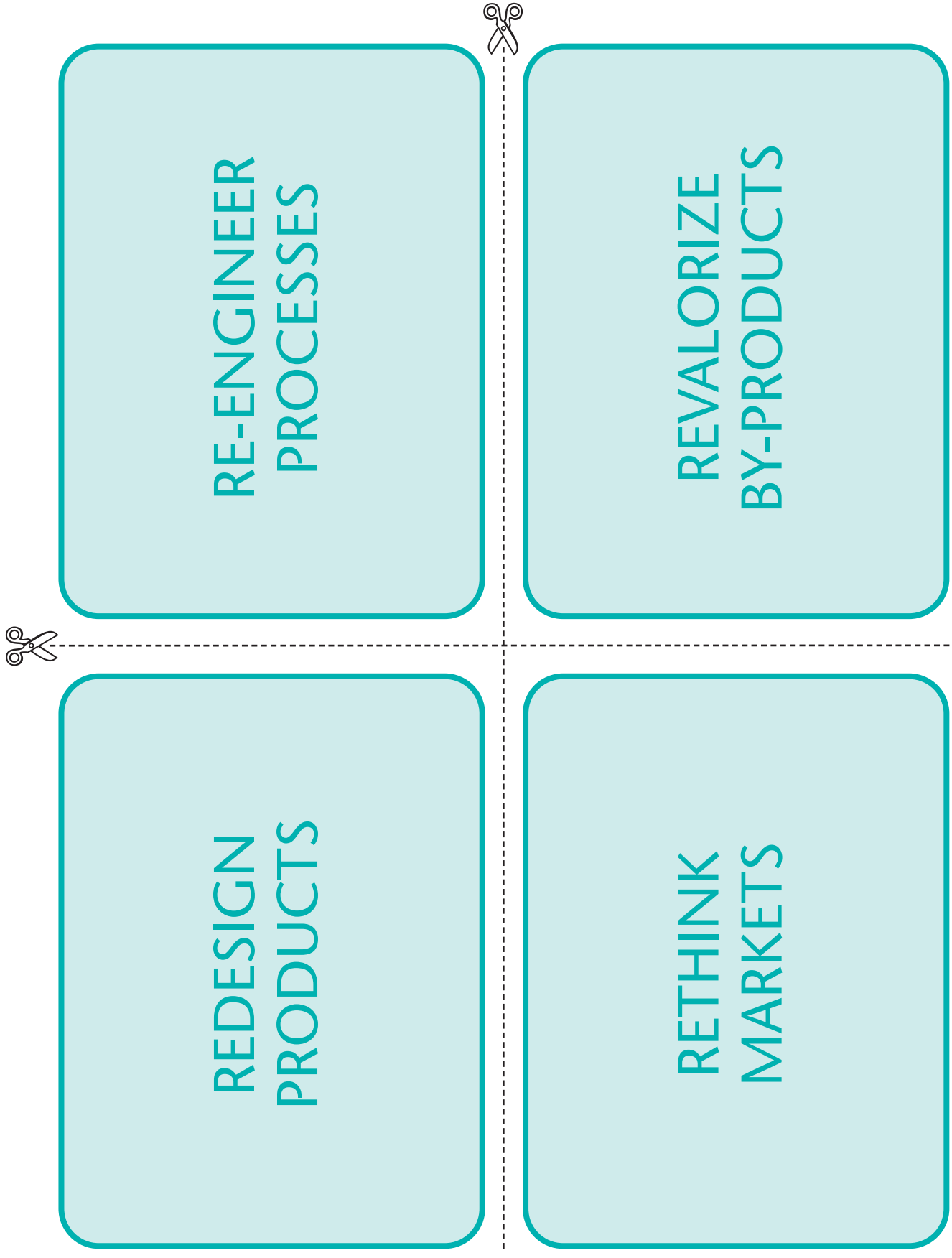
A variation to the activity is to include some blank cards in each card set for teams to fill in their own examples. Suggestions for blank cards include:

- other examples from personal experiences
- who within the company would be responsible for identifying opportunities under each heading
- challenges to implementing each of the four elements.

### Key elements of eco-efficiency: suggested answers

| RE-ENGINEER PROCESSES | REVALORIZE BY-PRODUCTS | REDESIGN PRODUCTS | RETHINK MARKETS |
|---|---|---|---|
| 1 | 17 | 44 | 2 |
| 54 | 33 | 8 | 9 |
| 21 | 11 | 23 | 26 |
| 39 | 12 | 51 | 53 |

## Key elements of eco-efficiency



# Key elements of eco-efficiency: definitions and examples

Reduces overall consumption of resources and pollution.

1

Uses waste from other products to create new products.

17

Looks for ways to increase the usefulness of the product without increasing waste.

44

Works with stakeholder groups to manage demand and supply.

2

Looks for new methods to turn raw materials into 100% product.

54

Argentine cement company ECOBLEND uses industrial refuse as an alternative fuel in cement kilns – saving 49,350 $m^3$ of fossil fuels, and keeping 122,500 tons of industrial waste out of landfill.

33

VW's Lupo car is designed for greater fuel efficiency, lower emissions and more recycled materials, and its materials are easily dismantled and sorted for recycling.

8

Xerox changed business strategy: from selling machines to selling copying services. As a result, profits increased while sales of units decreased and 1.5 billion pounds of equipment waste was recaptured.

9

# Key elements of eco-efficiency: definitions and examples

SC Johnson modified production so that waste emissions were cut by half even though production doubled.

21

Turns an existing cost item into a savings (or even better, a profit).

11

Soporcel's new lighter 75-gram office paper, Discovery 75, is made with less raw materials, uses less wrapper to pack the product and produces less waste due to its superior performance and lower weight.

23

Questions what function or service the consumer actually wants, and if it can be delivered some other way.

26

General Motors has slashed the amount of groundwater needed to produce each car at its Ramos Arizpe plant in north eastern Mexico from 32 $m^3$ in 1986 to 2.2 $m^3$ in 2000. It has done this by conservation, reuse, purification and recovery.

39

A Croatian dairy company has turned its wastewater sludge into a commercial compost material. Payback on the investment was less than 18 months.

12

Designing products that have higher functionality, better serviceability, easier upgradeability and simple disassembly for recycling.

51

Dow Chemical offers chlorinated solvents in a closed loop delivery system: it offers the safe delivery and take back of solvents as well as assistance to customers in their use. Essentially they are selling the use of the chemical, not the chemical itself.

53

# Key elements of eco-efficiency: definitions and examples

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 2.0 Understanding a life-cycle approach

**Did you know…**
A washing machine, if designed accordingly, can clean dirty clothing using 87% less water and 14% less electricity as compared to models from 10 years ago? Producing paper using a chlorine-free process uses between 20 and 25% less water, than conventional chlorine-based paper production processes? Producing one ton of recycled steel saves the energy equivalent of 3.6 barrels of oil and 1.5 tons of iron ore, compared to the production of new steel?[1]

## Background

Product consumption results in a wide range of extraction, manufacturing, processing, transportation and disposal operations. Dissecting a product into all the various processes that contribute to its production and disposal can help us better understand environmental impacts and identify inefficiencies. An analysis of all of these operations, called life-cycle or cradle-to-grave, documents the inputs (water, energy, raw materials) and outputs (products and wastes) for these various steps.[2]

Companies are looking at the entire life-cycle of products in response to increased environmental concerns from a range of stakeholders – consumers, competitors and governments. These companies are also recognizing the business value of understanding the life-cycle of their products: as a source of innovation and a way to avoid risks.

A life-cycle approach identifies the multiple environmental and resource issues across the entire life-cycle of the product. This information informs business activities, such as what materials to procure, how products are designed or marketed and business planning. Rather than just looking at the amount of waste that ends up in a landfill or an incinerator, a life-cycle approach identifies where the most energy is used, the types and amounts of materials used, where materials come from and where they end up, as well as types and amounts of wastes – all from the time raw materials are obtained to the final disposal of the product.[3]

Knowing more about this, companies employ the tools they need to reduce impacts across the life-cycle and capitalize on opportunities to save money or improve their products. Life-cycle tools range from simple mapping of life-cycle stages to comprehensive quantitative assessments (such as the International Organization for Standardization's 14040 series of standards on Life-Cycle Assessment, or LCA). The choice of tool depends on how the results are to be used.

[1] www.ecoelements.ca/facts
[2] Retrace your Waste: Life-cycle Analysis, www.erefdn.org/rpts_summary_ordrs/OunceofPrevention/LESSON11.PDF
[3] *Product Life-Cycle Analysis: Environmental activities for the classroom*, Waste Management and Research Center, Champaign, IL, 1999

Of course, there are limitations. There are dilemmas associated with understanding the boundaries of a particular product's life-cycle ("which is the 'cradle' and which is the 'grave'?" or "what can my company control or influence?"). Also, comparing one product with another, in terms of its life-cycle impacts, is tough, as is determining the relative importance of the issues examined at each life-cycle stage.[4] Also, current approaches tend to focus on environmental impacts, but less so on social impacts. For instance, how does the product impact our social well being – positively or in unintended negative ways?

A life-cycle approach helps allocate resources because it may help identify where the most energy is used or where the most expensive waste is generated, i.e. "getting the biggest bang for the buck".[5]

## Purpose & learning activities

In the following activities, participants work out the life-cycle stages of an everyday product and discuss the issues involved at each stage. The aim is to encourage thinking beyond product use to associated social and environmental impacts of manufacture, distribution and discard.

## Materials

We provide slides and handouts on the following pages. You may also need one or more examples of an everyday product (for example, a tennis shoe), as explained below.

## Facilitating the activities

The facilitator can pick and choose from the four activities outlined below, according to their own comfort with the topic and level of the participants:

| | | |
|---|---|---|
| Activity 1 | Slides introducing a life-cycle approach | all audiences |
| Activity 2 | A group discussion on life-cycle stages of an everyday product | all audiences |
| Activity 3 | Lawn chair manufacturing scenario: Applying life-cycle information to a business situation | some technical/scientific disciplines in the audience |
| Activity 4 | Questions for participants to reflect on the activities | all audiences |

For further background on these or other activities, please contact Kevin Brady at Five Winds International, k.brady@fivewinds.com or +1 613 722 6629, or Katherine Madden at WBCSD, madden@wbcsd.org.

[4] Retrace your Waste: Life-cycle Analysis, www.erefdn.org/rpts_summary_ordrs/OunceofPrevention/LESSON11.PDF
[5] www.ciwmb.ca.gov/EPP/LifeCycle/default.htm

# Activity 1 – Introduction to a life-cycle approach

This activity is essential for introducing the concept to participants – even if they do not also do activities 2, 3 and 4. Use the slides to explain to participants the concept of product life-cycles and a life-cycle approach to managing impacts across different life-cycle stages of a product.

The slides lead participants through the stages of a product, beginning with obtaining raw materials and ending with disposing of the product. Along the way, give examples of how energy is consumed and how waste products from air emissions, water effluents and solid waste are generated. Life-Cycle Assessment (LCA) – a quantitative tool – is introduced at the end as one way to quantify the environmental impacts of a product.

**Materials**

Slide deck.

**Take-away message**

Following the slides and discussion, participants should recognize where typical products come from, where they eventually end up and what types of impacts they have throughout. They may also recognize certain points for making changes or improvements (recycling, or using less water for a particular product). Overall, they should take away an ability to view products in terms of their complete life-cycle.

# Activity 1 Worksheet 1 – Introduction to a life-cycle approach (slides for facilitator)

DEDICATED TO MAKING A DIFFERENCE

## Understanding a life-cycle approach

Learning unit B: exploring eco-efficiency

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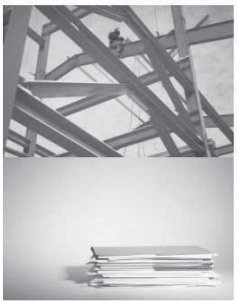
## Did you know...



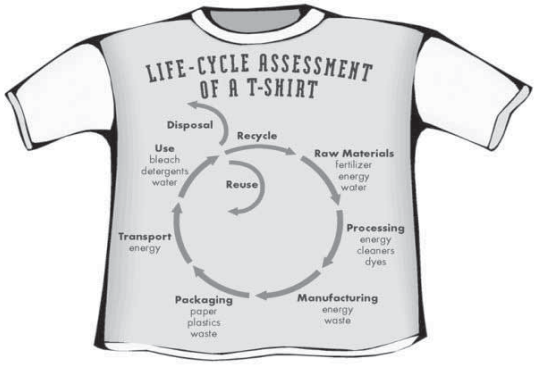
- Producing one ton of recycled steel saves the energy equivalent of 3.6 barrels of oil and 1.5 tons of iron ore, compared to the production of new steel?
- Producing paper using a chlorine-free process uses between 20 and 25 percent less water than conventional chlorine-based paper production processes?

## Learning objectives

- Recognize where products come from and where they go after use – *life-cycle*
- Think about a product's impacts on the environment and economy throughout
  - Qualify impacts
  - Quantify impacts

## Structure

- Life-cycle – what is it?
- Choosing boundaries and shifting issues
- A life-cycle approach
- Life-cycle assessment – one tool
- Segue to life-cycle exercise




Worldwatch Institute, Worldwatch Paper 166: Purchasing Power: Harnessing Institutional Procurement for People and the Planet, July 2003, www.worldwatch.org

## Life-cycle stages

- Products can be evaluated through each stage of their life-cycle:
  - Extraction or acquisition of raw materials
  - Manufacturing and processing
  - Distribution and transportation
  - Use and reuse
  - Recycling
  - Disposal
- For each stage, identify inputs of materials and energy received; outputs of useful product and waste emissions
- Find optimal points for improvement – eco-efficiency

## A life-cycle approach

- Ensures companies identify the multiple environmental and resource issues across the entire life-cycle of the product
- Knowledge of these issues informs business activities:
  - planning, procurement, design, marketing & sales
- Rather than just looking at the amount of waste that ends up in a landfill or an incinerator, a life-cycle approach identifies energy use, material inputs and waste generated from the time raw materials are obtained to the final disposal of the product *

* *Product Life-Cycle Analysis: Environmental activities for the classroom,* Waste Management and Research Center, Champaign, IL, 1999

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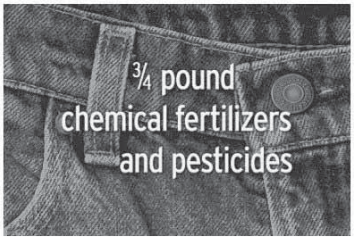
## Identifying issues at each life-cycle stage




*Estimated amount of synthetic fertilizers and pesticides it takes to produce the cotton for a conventional pair of jeans.*

Source: "The Organic Cotton Site: Ten good reasons"

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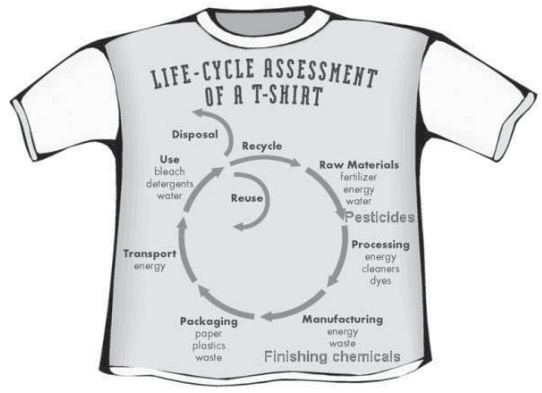
## Life-cycle – identify the boundaries




Worldwatch Institute, Worldwatch Paper 166: Purchasing Power: Harnessing Institutional Procurement for People and the Planet, July 2003, www.worldwatch.org

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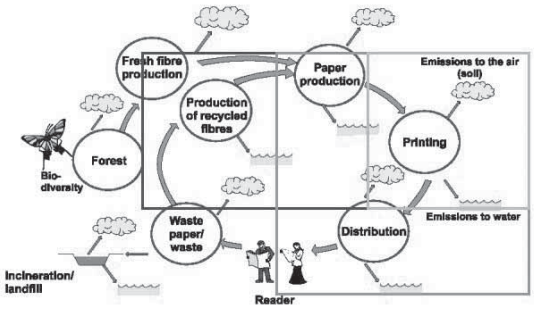


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## Life-cycle – helps avoid shifting the issues

- **Looking at the entire life-cycle helps ensure reducing waste at one point does not simply create more waste at another point in the life-cycle**
- **Issues may be shifted – intentionally or inadvertently – among:**
  - Processes or manufacturing sites
  - Geographic locale
  - Different budgets and planning cycles (first cost)
  - Environmental media – air, water, soil (MTBE)
  - Sustainability dimension: economic, social, environmental burdens
- **Depends on "boundaries"**
- **Be conscious of what is shifted and to where!**
- **For example, MTBE…**

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## Methyl tertiary butyl ether - MTBE


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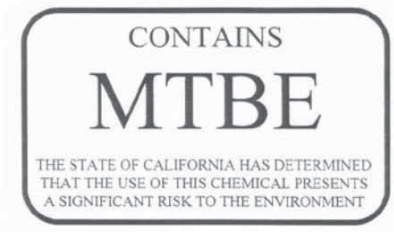
## Methyl tertiary butyl ether - MTBE

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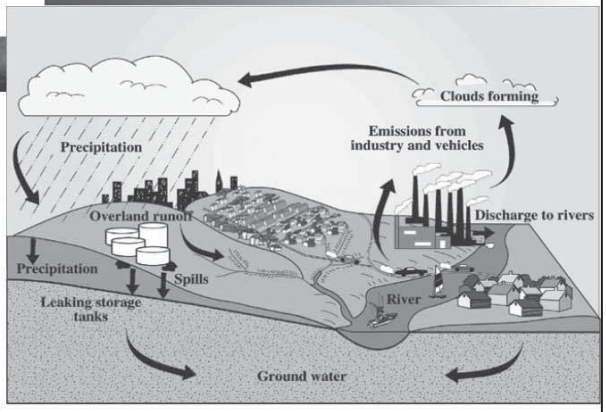


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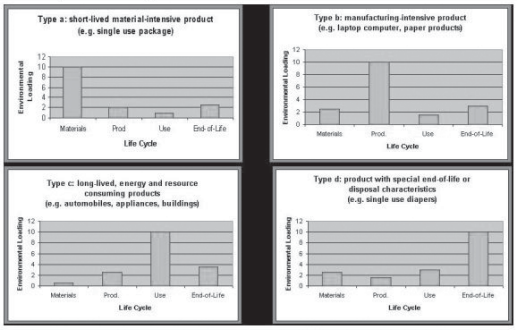
US Geological Survey, http://www.nwrc.usgs.gov/world/content/water1.html

## Different products have impacts at different life-cycle stages

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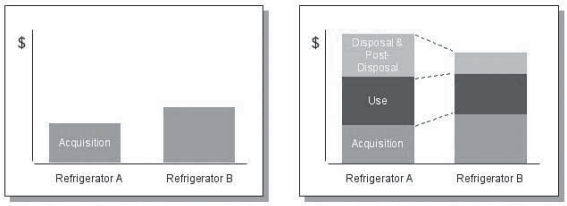
## Life-cycle – identify issues and costs




Purchase Price

Refrigerator A appears cheaper

Price + Life-Cycle Costs

Refrigerator B costs less overall

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## A life-cycle approach

- With a life-cycle approach, companies employ the tools they need to:
  - Reduce impacts across the life-cycle
  - Capitalize on opportunities for their business
- Tools range from simple mapping of life-cycle stages to comprehensive quantitative assessments

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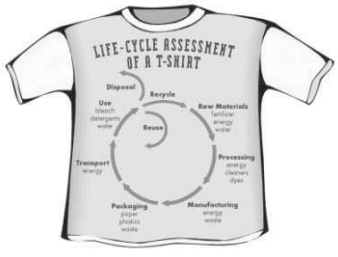
## Life-cycle assessment

- LCA is a tool to systematically measure the environmental impacts associated with each stage of a product's life-cycle

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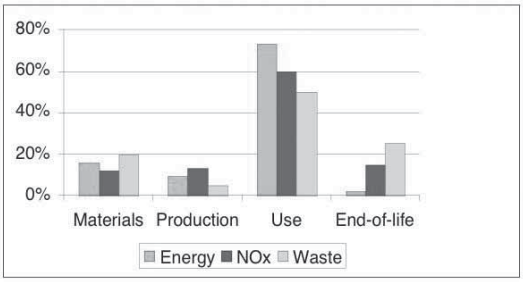
## Life-cycle assessment

*Assessment of relative impacts across life-cycle – 3 issues are included*

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## Life-cycle assessment

- Two attributes make LCA distinct and useful as an analytical tool:
  - whole system consideration of the total product life-cycle
  - presentation of tradeoffs among multiple environmental issues
- LCA is quantitative

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## How to do LCA

1. Determine scope and system boundaries
   - functional unit
   - life-cycle stages
   - define "unit processes"
2. Data collection
3. Analysis of inputs and outputs
4. Assessment of numerous environmental issues
5. Interpretation
   - LCA principles and framework are standardized by the Organization for International Standardization's 14040 series of standards (ISO14040)

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## Conclusions – why take a life-cycle approach?

- Systems perspective
- Integrates environment into core business issues
- Efficiency
- Innovation
- Better return on investment – identify point of "biggest bang for the buck" *
- Engage stakeholders – investors, customers, employees
- Environment is not a cost center for the company, but a business opportunity

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* www.ciwmb.ca.gov/EPP/LifeCycle/default.htm

## Conclusions – why take a life-cycle approach?

- Systems perspective
- Integrates environment into core business issues
- Efficiency
- Innovation
- Better return on investment
- Engage stakeholders
- Environment is not a cost center for the company, but a business opportunity
  - Look beyond the company's gate
  - Expose trade-offs and and opportunities
  - Expand analysis of products, projects, policies and programs – what is the function, what are the boundaries, what are the impacts, where are the opportunities?

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## Hamburger exercise – life-cycle stages, inputs, outputs and issues …

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NB: Slide with four product graphs available in Powerpoint version only

# Activity 2 – Life-cycle stages of an everyday product

This activity is suitable for a facilitator new to the concept of life-cycle, and likewise is suitable for participants being introduced to the concept for the first time.

Show everyone in the group an old tennis shoe (or an object of interest or relevance to the group) and ask them to consider it. As a group, the participants should identify the different types of materials that the shoe is made of. Write these down on a white board or flip chart where everybody can see them. This list will probably include leather, nylon, canvas, plastic, rubber and cotton. Add to the list the packaging materials the shoe came in from the store (this could include cardboard shoe boxes, tissue paper, plastic bags and paper bags).

Start a discussion by asking the participants where their shoe came from, helping them by including the various components they just listed. For example, the leather came from a factory that processes and cuts leather, which is then delivered to the shoe manufacturer. Further back to the raw materials, the leather comes from cattle via a slaughterhouse and tanning factory. You may want to develop a type of flow chart for several of the components of the shoe to get across the idea that all the various parts are a result of a number of manufacturing processes.[6]

**Option**

Alternatively, if your knowledge of, or comfort with the concept of life-cycle stages is low, use the handout Life-cycle mapping of a burger, on the following pages.[7] Print yourself a copy and use it to prompt the group during discussion. The participants are not looking for detailed results but for an overall picture of what materials are used, main unit processes to manufacture and transport, types of use and eventual reuse or disposal.

**Option**

Instead of a large, full group, you may also have each person work individually using the handouts Life-cycle assessment: identifying the inputs and outputs. Each represents a different phase of the product's life-cycle and has different questions for the participant to think about. Once participants have worked through the sheets on their own, ask participants to call out the things they noted for each life-cycle stage. The participants are not looking for detailed results, but for an overall picture of what materials are used, main unit processes to manufacture and transport, types of use and eventual reuse or disposal.

**Materials**

Depending on the option you choose, you will need a product of your choice (e.g. a tennis shoe or something relevant to your audience) or the handout Life-cycle assessment: identifying the inputs and outputs.

**Take-away message**

Through discussion and brainstorming, participants should come to realize:
what the life-cycle of a product encompasses; what the key life-cycle stages are; potential impacts at different stages; points for improvement; and the importance of people at each stage interacting with one another (to find ideal places for improvements).

[6] Retrace your Waste: Life-cycle Analysis, www.erefdn.org/rpts_summary_ordrs/OunceofPrevention/LESSON11.PDF
[7] ibid

# Activity 2 Worksheet 1 – Life-cycle analysis of a burger

*This example is from the National Science Teachers Association*
www.erefdn.org/rpts_summary_ordrs/OunceofPrevention/LESSON11.PDF

**The burger**

1 Grain is grown, using a variety of fertilizers, herbicides, pesticides and significant amounts of water. Threshers, combines and tractors are used to sow, grow and reap the grain. All of this equipment burns fuel and emits pollutants and greenhouse gases.

2 The grain is shipped to cattle ranches or feedlots, where it is fed to cattle, along with water. Waste products include manure and methane.

3 Cattle are shipped by truck or train to market, where they are fed and sold.

4 At processing plants, the cattle are slaughtered and cut into large sections called primal cuts – quickly refrigerated and aged. Waste products include unusable animal parts, wastewater and manure.

5 The beef is shipped in refrigerated trucks and rail cars to food service warehouses, where it is ground, formed into patties and boxed and wrapped for use. It is stored and frozen until needed.

6 Beef patties are shipped via freezer trucks to stores and restaurants. They are kept in cold storage until needed, then cooked on a broiler or fryer. They are then put on a bun, topped with condiments, wrapped and put under lights until served.

7 Uneaten portions are thrown away.

**Bun and condiments**

8 Grain is grown for use in baking. Tomatoes, onions, pickles and lettuce are grown, using fertilizer, pesticides and herbicides, plus large quantities of water. Farm machinery is required. Machinery uses fuel and some chemicals run off into water reserves.

9 Grain is shipped to mills, where mechanical equipment converts it into flour. The flour is packaged in bulk bags. Wastes include excess or unusable portions of the grain and excess packaging material. Vegetables are shipped to refrigerated warehouses, and held in storage until needed. Then, they are sent by refrigerated truck to stores and restaurants, where they are cut up, cooked and served.

**10** Some tomatoes, cucumbers and onions are shipped to processing companies. Using mechanical equipment, tomatoes are processed into ketchup, cucumbers are pickled, and onions and pickles are used to make relish. Significant quantities of water are used in these processes. Ketchup production also requires high heat cooking. All food must be vacuum packed for freshness and sanitation.

**11** The flour is shipped by truck or rail to bakeries, where it is mixed with water and other ingredients. The dough is then baked in ovens, which require significant heat energy in the form of gas, oil, electricity or wood. Once cooled, the buns are packaged and warehoused. Condiments also are packaged and shipped to warehouses. Then they are shipped to local stores. Waste includes leftovers, which are thrown away.

**12** The buns are trucked to local stores, where they are used to make hamburgers. Waste includes leftover bread, which is thrown away.

## Packaging

**13** Trees are cut and oil or gas is drilled. The lumber and petroleum are shipped or piped to mills and refineries, respectively. Sand, soda and potash are mined and shipped to glass plants.

**14** At the mill, lumber is pulped, using very large quantities of water and corrosive chemicals, including chlorine. Large machines then turn the pulp into paper, which is wound on rolls and stored. At the refinery, petrochemicals are converted into ethylene, which is then polymerized to become polyethylene. Polyethylene is formed into pellets, packaged in bags and boxes and stored. Significant energy is required during these processes. At the glass plant, the ingredients are mixed into the proper proportion and heated to very high temperatures, at which they melt to form glass. The molten glass is poured into molds and cooled to make bottles.

**15** The paper and plastic are shipped via truck or rail to manufacturing plants, which make a variety of products: polycoated paper for use in wraps and boxes (“clam shells”), paper for use in bags, plastic wrap for use in bread, meat and vegetable packaging, and cardboard for use in pallets and boxes. Glass bottles are shipped to the ketchup and relish plants, which use them for packing.

**16** Finished packaging is shipped to points where it is needed. Wastes include most, if not all, of the used packaging, including the clam shell and/or wrap used to provide you with a fresh-cooked, sanitary hamburger.

# Activity 2 Worksheet 2 – Life-cycle assessment: identifying the inputs and outputs

## What to do

"Life-cycle analysis (LCA) is a key tool for environmentally sensible design and decisions, and information is a key challenge to LCA. The concept of identifying and evaluating the 'cradle to grave' environmental and resource impacts of any product or process is sound, insightful, and worthwhile – so much so that it is the subject of growing attention around the world in a wide range of industries, and a component of the emerging ISO 14000 standards."[8]

LCA begins by first breaking the life-cycle into finite stages, i.e. raw materials and procurement – see diagram. For each stage of the life-cycle, you can examine:

- the most significant inputs such as energy, water, raw materials, equipment, supplies
- finished goods and outputs, products, product use, and non-product outputs, and
- processes (focusing first on those with the largest inputs or outputs).[9]

Use the rest of the worksheet to identify your inputs and outputs.

**PRODUCT:**

### Sourcing materials

- What raw materials are used in the product?
- What processes are used to extract the raw materials?
- How much energy is required for extraction?
- Has water been used?
- Has land been used?
- What manpower is used?
- Where were they built or manufactured?
- How are they transported to the production site?
- Who is involved?
- Who sources?

[8] National Logic, www.natlogic.com/resources/nbl/v05/n13.html
[9] www.ciwmb.ca.gov/EPP/LifeCycle/default.htm

**PRODUCT:**

### Distribution

- How is the product distributed?
- What transportation is used?
- What packaging is used?
- How is the product stored – does it require refrigeration or use of electricity?
- Who distributes the product?

### Production

- How far do the raw materials travel for production purposes?
- How is the product produced?
- What processes are used: water, waste, air emissions, noise, and energy consumption?
- Who produces the product?

**PRODUCT:**

### Use

- Who uses the product?
- Can the product be used independently?
- Is energy required to use the product?
- What about other inputs (such as products needed for cleaning or maintenance)?
- How does the product travel from where it is distributed to where it is used?

### Disposal

- What happens to the product when its use is completed?
- What is the recyclability of the product?
- Who disposes of or recycles the product?

# Activity 3 – Lawn chair manufacturing scenario: applying life-cycle information to business situations

This activity is suitable for a facilitator very familiar with a product's life-cycle stages and environmental effects, and identifying product changes which may reduce those effects. The participants should be intermediate in their understanding of eco-efficiency as it may apply to manufacturing, procurement, product development and sales in a company.

Working in small groups of five, this exercise takes participants beyond life-cycle mapping to assessing the environmental impacts of a product and using that information to inform a business decision.

Tip: The activity will work best if the group includes some participants with technical or manufacturing expertise. Try to split participants such that each group has a mix of disciplines. If the group has few technical people, consider foregoing this activity and focusing only on activities 1 and 2.

## Materials for activity 3

All materials are provided on the following pages.

**Five role cards:** Each person needs one "role" card. There are five "roles" and each card names the role, describes that role and is numbered from 1 to 5. Later this number will help participants form teams (such that each team will be comprised of five people, each with a different "role"). Print role cards, cut them out and hand one to each participant.

**Information package:** Each team needs an information package about Sessel Manufacturing Inc. and its current situation.

**Facilitator information package:** The facilitator needs the facilitator copy of the information about Sessel Manufacturing, to read aloud to the entire group (it contains prompts).

**Slides for exercise:** The facilitator needs a slide outlining the team's tasks, assigned by Sessel's CEO. Post the slide after each team has had time to read the information package. Leave the slide up during the exercise.

**Slides for closing exercise (optional):** Finally, the facilitator needs slides outlining the "real story" to present at the close of the exercise. The facilitator should also print copies of the real story to hand out to participants (do not hand these out until the exercise is complete – participants will hesitate if they know there is a "right" answer).

**Facilitating activity 3**

Provide each participant with a role card and information package.

Read aloud, from the facilitator copy, the information about Sessel Manufacturing Inc. and its current situation (10 minutes).

Read aloud the tasks requested by the CEO and the details regarding the lawn chair's manufacture, distribution and use (10 minutes).

Put up the Brainstorming slide. Ask each participant to work individually on the first task, generating options for changing and improving the lawn chair (materials used, transportation, manufacturing process, etc.) (10 minutes).

Encourage participants to think about their role and about their responsibilities/interests within Sessel Manufacturing Inc.

Gather individuals into teams of five according to the numbers on their role cards. Direct each team to its next task of discussing individual ideas and selecting which to present to the CEO (20 minutes).

Put up the Project Team work slide (marketing value, benefits, feasibility). Again, remind participants to think about their roles when assessing options.

Ask each team to present one option to the whole group. Write each team's option on a white board. Write also whether the team sees it as a short- or long-term action and the anticipated benefits of each option. After writing each team's contribution on the white board, ask a spokesperson to read aloud the option and benefits (this should clarify the team's thinking for the whole group). Ask if any team has additional options that should be added or whether it can suggest additional benefits for any of the options already listed.

Collectively, reflect on the exercise and how it illustrates the use of life-cycle information to create a business case and inform a business decision.

Optional: Close the exercise by presenting the "real story" slides. They outline what happened at the real manufacturing company upon which this scenario is based. The slides show how the company used quantitative information from a life-cycle assessment to inform the product design and business decisions.

**Take-away message**

During the activity participants should gain experience with cross-disciplinary group discussions about product design and potential environmental benefits or drawbacks. They should also gain insight into the link between business objectives, operations and environmental initiatives. Finally, participants are introduced to the tool, life-cycle assessment, and its use in generating quantitative data as input to decision making.

# Activity 3 Worksheet 1 – Applying life-cycle information to business situations (role cards for participants)

Production
(Project Team 1)

You are concerned with assembly and speed to market, processing, tooling and distribution.

*remember to bring your own experience and ideas in to your role*

Design
(Project Team 1)

You are concerned with product function, materials, aesthetics, quality and the process to produce it.

*remember to bring your own experience and ideas in to your role*

Marketing & Sales
(Project Team 1)

You are concerned with market demand and changes in demand, customer response and perceptions, staying on top of trends.

*remember to bring your own experience and ideas in to your role*

Management
(Project Team 1)

You are concerned with planning projects, strategic direction of the company and its products, staying on top of trends.

*remember to bring your own experience and ideas in to your role*

Finance & Purchasing
(Project Team 1)

You are concerned with cost of production, logistics and quality to the customer and user.

*remember to bring your own experience and ideas in to your role*

Create additional cards to suit the number of participants…
i.e. Teams 1 through 5 or more, as needed

# Activity 3 Worksheet 2 – Applying life-cycle information to business situations (notes for facilitator to read aloud to participants)

**Background and set-up**

We all work at Sessel Manufacturing Inc., producing outdoor metal furniture for a consumer market. We are a small company, with 200 employees in high season but only 150 in the off-season.

Our major clients are large-scale multiple-outlet retailers, in two countries with 40% and 60% of our sales, respectively.

*[Ask participants to take top card and pass stack until everyone has one card.]*

Sessel divisions represented in this room are Marketing & Sales, Production, Finance & Purchasing, and Management.

A couple of things have started happening here at Sessel recently. As the folks from Marketing & Sales know, it began when one of our major clients, a retailer called Retail Inc., implemented an Environmental Management System at their facility. They have subsequently begun to improve their organizational operations, including distribution and retailing. Now, Retail Inc. is responsible for 20% of our sales, so our management tells us that our CEO is now keen for Sessel to demonstrate leadership in environmental improvement in our industry sector and to our customers and the community here where we operate. Our CEO has just announced this publicly and stated that Sessel is firmly committed to integrating our environmental performance with our economic measures. Our folks in Finance & Purchasing are all too aware of this last point.

Internally, we all know that we cannot currently afford to structure an Environmental Management System and have it externally certified according to ISO Standard 14001 (like our customer Retail Inc. has done). Our CEO has discussed this with Retail Inc. Together they have agreed that instead, Sessel could demonstrate leadership and commitment to better environmental performance by improving our product systems and processes. The assumption is that the end customer will recognize this, and if properly communicated, it will reflect positively upon Retail Inc. and Sessel.

Retail Inc. also recognizes an increasingly demanding set of regulations are being considered by local government. These would require Retail Inc. to report on all the products they sell to consumers including a number of their health and environmental attributes. Therefore, they want to be prepared.

**The task**

Because of this situation, our CEO has brought all of us together to generate options to improve the environmental performance of one of our outdoor metal furniture products – in this case, a lawn chair.

*[Put up TASK slide]*
We have been asked to work together on two tasks:

1) Generate options for improvement, as per our customer and market needs; and present the business case for the option to the CEO.

2) To do this, we'll brainstorm individually and then form groups.

First, let's review the lawn chair, how it is made and used.
*[Put up lawn chair details slide]*

- Design is done in-house; all metal and plastic parts.
- Suppliers provide component plastic parts (i.e. armrests, feet, tube plugs/caps, etc.).
- All metal work production done in-house (i.e. cutting, bending, welding, deburring).
- All finishing and assembly done in-house.
- For distribution, corrugated paper is used for protection during stacking of chairs. Stacks of chairs are wrapped on pallets.
- Customer use is seasonal and occasional. Lawn chair is exposed to 1) weather and seasonal fluctuations, 2) heat, 3) ultraviolet light, 4) rain and humidity, and 5) occasional snow.
- At end of customer use, lawn chair may go to secondary use / garage sale, but is ultimately sent to landfill.

**The task – step I**

Jot down some ideas for changing or improving the product system and for reducing any negative environmental impacts. This is brainstorming, so no idea is too outrageous – everything and anything is worth writing down.
*[Put up Brainstorming slide]*

As representatives from different divisions within Sessel, you each have a lot of unique experience with the company and are quite knowledgeable. Remember to think about the division you represent and see if you can come up with additional ideas.

**The task – step II**

Now look at the number on your role card and form a project with the other four persons with the same number.
*[Put up Project Team work slide]*

As a team, spend 10 minutes discussing ideas for improving the lawn chair system. Then choose five ideas which your team thinks:

- will provide "marketing value" to Sessel or the retailer
- have distinct benefits (e.g. for design, marketing, production, purchasing/sourcing, management/strategy) in the long and short term
- are technically and economically feasible, as deemed by the expertise in your team.

Work as a team to select the top option and prepare your case for the CEO – outline whether it can be implemented immediately or over the longer term, and the associated benefits, either for Sessel, for Retail Inc., for both or other benefits.

**The task – step III**

Okay, now we want to show our CEO the options we have come up with.

Which team would like to begin describing their ideas for improving the lawn chair product system?

*[Write each team's idea on white board; note whether it is a short- or long-term action and document any anticipated benefits. Ask the larger group if there are additional ideas to write down. Or additional benefits to add to any of the ideas on the board?]*

**Reflect**

Now, let's reflect on the exercise: We began by outlining our situation and drivers for change – from inside and outside the company. Next, we identified a product to change and then outlined the life-cycle information we had about that product. Later we brainstormed options drawing on the perspective and experience of those who work most closely with the product and the product system. The next step was to screen those options according to the potential benefits for Retail Inc. or for Sessel (e.g. for our design, marketing, production, purchasing/sourcing, management/strategy).

If we took this exercise further, the next step may be for the company to make a decision based on the options presented. This would likely be done according to the techniques normally applied in the company for assessing feasibility and market opportunities. In some cases, the company may want more information and choose to do a quantitative screen of the product life-cycle. This could involve a formal life-cycle analysis of the lawn chair, which quantifies all the inputs and outputs of the lawn chair system to find where the greatest issues arise. You can see it does not necessarily require a lot of resources or special expertise to improve the environmental performance of a product – simply draw on the knowledge and experience of persons in the organization. It does require people to take a slightly different perspective in the design and development of products.

It is valuable to see how many options you generated in this exercise without having a lot of detailed quantitative information about the lawn chair.

We should also emphasize the importance of "cross-disciplinary teams" in screening the product and developing improvement options. It is valuable to have the perspective and knowledge of people representing the whole product system.

**Closing**

Now... let's look at what really happened at Sessel!

*[walk through real story slides]*

Sessel's CEO was strongly driven to implement environmental considerations into the economics of their business. The company believed the largest environmental impact from the product was at the end of its life, when disposed (i.e. sent to landfill). So, Sessel initiated a Life-Cycle Analysis (LCA) study to identify what the actual impacts were and whether they could be addressed successfully and economically.

The Life-Cycle Analysis modelling revealed that the manufacturing stage incurred the major impacts from the product. Specifically, the powder coating finishing process had the greatest adverse environmental impacts in terms of energy demand.

In the slides, we see the material flow modeled in a Life-Cycle Analysis modelling software. The blue arrows indicate the size of material flow from pretreatment through spray booth to drier.

In the slides we see the energy flow, where the orange indicates the size of energy flowing into pretreatment, spray booth and the drier. Here, the primary forms of energy are electrical power and thermal energy.

In the slides, the pie graph shows the distribution of energy consumption to finish the chair: powder dryer uses more than 80% of the total energy.

This bar graph shows different design options generated by the team. The team evaluated and compared the options according to the amount of primary energy use throughout the product life-cycle. In the end, a long-life design was selected, with stainless steel construction and without any coatings or finishes.

In the slides, you can see the stainless steel, long-life design without coating or finishing is the preferable option in terms of cost. The biggest difference comes in the costs for capital and energy, which are minimal to nil for this design.

The life-cycle study and selection of new design took three months and cost the company $37,500. Estimations indicate the new design saves the company $6,000 per week and thus the return on investment is six weeks.

How does this compare to the benefits our project teams came up with? Were these and other benefits illustrated in our exercise?

# Activity 3 Worksheet 3 – Applying life-cycle information to business situations (slides for facilitator)

DEDICATED TO MAKING A DIFFERENCE

## Understanding a life-cycle approach

Learning unit B: Exploring eco-efficiency

*Exercise: Sessel Manufacturing Inc.*

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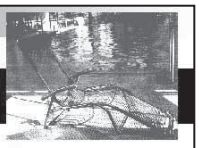
## Learning objectives

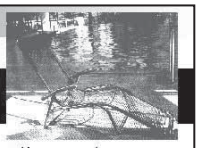


- Experience cross-disciplinary group discussions on business objectives, operations, product design and environmental performance
- Gain insight into link between business and environmental initiatives

## Sessel Manufacturing Inc.

**Sessel Manufacturing Inc.**


## Our tasks

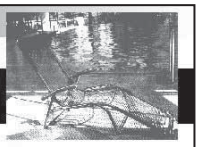


We have been asked to work together on two tasks:

1. Generate options for improvement, as per our customer and market needs
2. Present the business case for the option to the CEO

To do this, we'll first brainstorm individually and then form groups

## Lawn chair details



**Design**
- in house; all parts metal and plastic

**Suppliers**
- provide component plastic parts (i.e. armrests, feet, tube plugs/caps, etc.)

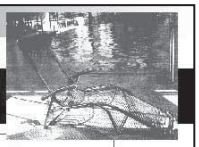
**Production**
- all metal work production done in house (i.e. cutting, bending, welding, deburr)
- all finishing and assembly done in house

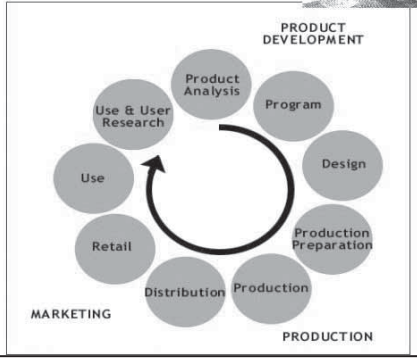
**Distribution**
- corrugated paper used for protection during stacking of chairs
- stacks wrapped on pallet

**Use**
- customers use seasonally and occasionally
- chair exposed to 1) weather and seasonal fluctuations 2) heat 3) ultraviolet light 4) rain and humidity 5) occasional snow

**End of use**
- lawn chair may go to secondary use/garage sale
- ultimately sent to landfill

## Brainstorming





## Project team work

Discuss ideas from all individuals and choose the top five

For those five, consider whether they:

- Will provide marketing value to Sessel or the retailer
- Have distinct benefits (design, marketing, production, purchasing/sourcing, management/strategy)
- Are technically and economically feasible, as deemed by the expertise in your team

Select the best option and outline your case for the CEO

- Action Plan: what are the short- and long-term actions?
- What are the associated benefits for Sessel, Retail Inc., both?

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## The real story

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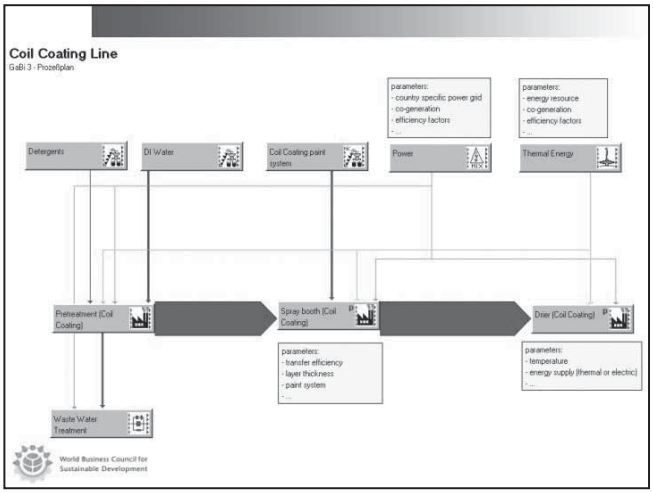
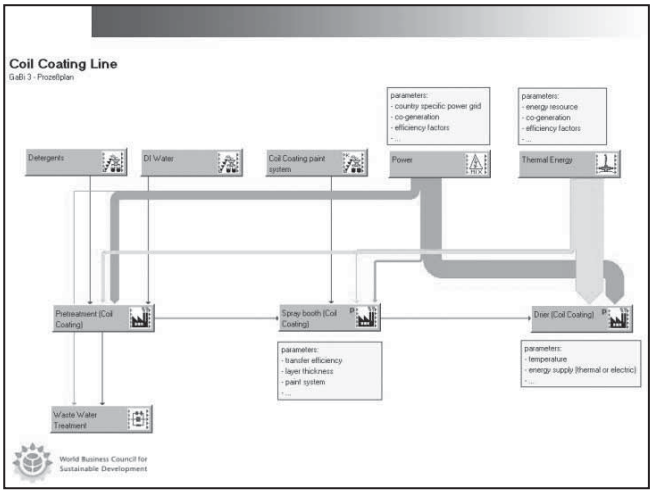
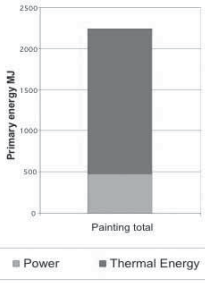
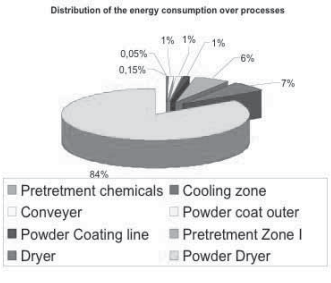



## Energy use during finishing

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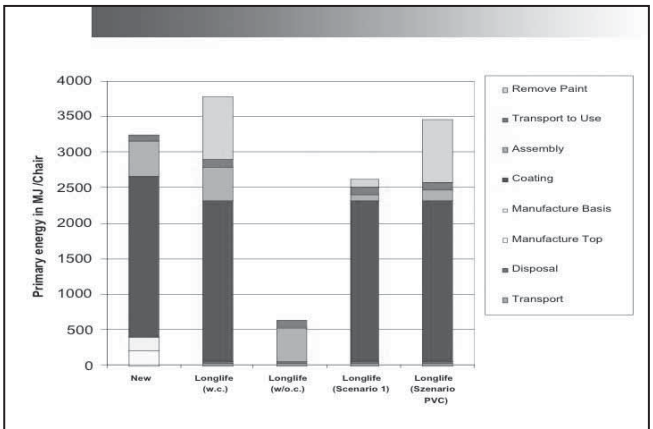


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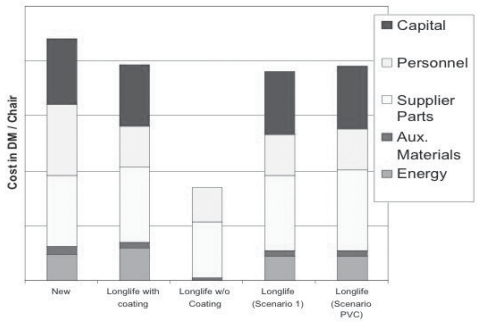
## Cost comparison between design options




## Details of the life cycle study

| | |
|---|---|
| **Project Duration:** | **3 Months** |
| **Project Cost:** | **$37,500** |
| **Cost Savings:** | **$6,000 per week** |
| **Return on Invest:** | **6 weeks** |

**Bonus:**
**future market increase expected due to longer life and consumer satisfaction**

# Activity 3 Worksheet 4 – Applying life-cycle information to business situations (handout for participants)

## Our company

For this exercise, you are employed by a company called Sessel Manufacturing Inc. At Sessel, we produce outdoor metal furniture for a consumer market. We are a small company with 200 employees during high season but only 150 in the off-season. Our major clients are large-scale multiple outlet retailers, two countries with 40% and 60% of our sales respectively.

## Our current situation

In the room around you are people from five different divisions of Sessel: our Design division, the Marketing & Sales division, our Production division, our Finance & Purchasing division and individuals from Management. We have all been asked to attend today's meeting in response to some recent events here at Sessel.

One of our major clients, a retailer called Retail Inc., has implemented an Environmental Management System at their facility. Thus, they have begun to assess and improve their organizational operations, like distribution and retailing operations. As we here at Sessel all know, Retail Inc. is responsible for 20% of our sales and so our CEO is now keen that we demonstrate leadership in environmental improvement in our industry sector, to our customers and in the community where we operate. Our CEO has just announced this publicly and also has stated that Sessel is firmly committed to integrate environmental performance with our economic measures.

Internally, we all know that we cannot currently afford to structure an Environmental Management System and have it externally certified according to the ISO Standard 14001 (like our customer Retail Inc. has done). Our CEO has discussed this with Retail Inc. Together they agreed that instead, Sessel could demonstrate leadership and commitment to improve environmental performance by improving our product systems and our processes. The assumption is that the final end customer will recognize this and if properly communicated it will reflect positively upon Retail Inc. and Sessel. Retail Inc. also recognizes that local government is considering increasingly demanding regulations. These would require Retail Inc. to publicly report a number of health and environmental attributes about all of the products they sell to consumers. Therefore, the company wants to be proactive and prepared.

## Our task today

Because of this situation Sessel's CEO has gathered us together today to:

- Generate options for improving the lawn chair we sell to Retail Inc., thus improving our product and going beyond the expectations of one of our important customers
- Present a case for moving ahead with one of these options, outlining the business benefits for Sessel and/or for Retail Inc. and a plan with short- and long-term actions.

**The lawn chair information we have**

- Design is done in house; all parts metal and plastic.
- Suppliers provide component plastic parts (e.g. armrests, feet, tube plugs/caps).
- All metal work production done in house (i.e. cutting, bending, welding, deburr).
- All finishing and assembly done in house.
- For distribution, corrugated paper is used for protection during stacking of chairs. Stacks of chairs are wrapped on pallets.
- Customer use is seasonal and occasional. Lawn chair is exposed to 1) weather and seasonal fluctuations, 2) heat, 3) ultraviolet light, 4) rain and humidity, 5) occasional snow.
- At end of customer use, lawn chair may go to secondary use/garage sale, but is ultimately sent to landfill.

## Task 1 – step I

Given your "role" at Sessel and your knowledge and experience with the company, take a moment to consider these details about the lawn chair. From the perspective of the division you represent, jot down ideas for changing the product or related processes. At this point no idea is too outrageous – write down everything and anything you can think of. When you are done, you will gather into small groups to discuss more ideas.

**Remember the key elements of eco-efficiency - options for eco-efficient products and services**

- Re-engineer processes
- Revalorize by-products
- Redesign products
- Rethink markets

**Task 1 – step II**

Assemble into your project team. Discuss everyone's ideas. Select the top option and then talk about how it provides business value to Sessel or to Retailer Inc., any distinct benefits along with short- and long-term actions.

Note the key points and benefits to present to Sessel's CEO.

Other notes

# Activity 4: Questions & feedback

For this last activity, use the following questions to facilitate a follow-up discussion as a group. Alternatively, allow participants to work independently and write their answers down. Pick and choose from the questions, using those relevant to the activities you used with participants (activity 1, 2, 3 and/or 4).

**Follow-up questions**[10]

- What inputs and outputs resulted from the manufacture of this product?
- Are all the outputs equal in terms of environmental effects?
- From which life-cycle stages did the environmental effects arise? Could any effects be minimized (remember the importance of function, performance and customer satisfaction)?
- Who would benefit from minimizing these effects? How do they benefit and when?
- What other resources were consumed as a result of this product's manufacture and distribution?
- Is it possible to weigh one aspect (air, water, land pollution or solid waste) as being more important than another? How? Why? Who makes these decisions in our society?
- In what way can identifying effects at each life-cycle stage help you understand the social and environmental impacts associated with products?
- In your company, what are the main life-cycle stages for your product? What related environmental effects are you aware of?
- In which ways can the market contribute to more positive changes?
- Which other stakeholders, if any, are responsible for improving the life-cycle?

[10] These questions are drawn from Retrace your Waste: Life-cycle Analysis, www.erefdn.org/rpts_summary_ordrs/OunceofPrevention/LESSON11.PDF

# 3.0 Reviewing news stories

## Background

Eco-efficiency is an emerging and constantly changing area which is increasingly in the public eye. Newspaper articles are therefore a useful tool in raising issues that companies are facing. They can demonstrate the broader picture of eco-efficiency within companies and demonstrate how organizations are constantly reviewing their business practices, and how eco-efficiency is becoming more mainstream.

## Purpose & learning objectives

In this activity we use newspaper articles to raise issues at the level of corporate, organizational or societal strategy and planning, and to encourage a range of different thinking including reflection and action.

The aims of this activity are to:

- encourage participants to think about and understand the context of eco-efficiency within organizations
- demonstrate how companies need to continuously review business practices
- help participants to relate global issues to their individual company's experience
- provide a space to debate and discuss issues some of today's companies are facing.

## Materials

We provide a selection of handouts in the following pages. Each handout summarizes the content of a newspaper report or article and includes some starter questions for discussion. You might also like to research other articles of particular relevance to your own organization and the participants.

Before the session, select an article or articles to use, and think through the relevance of the issues to your workplace in order to ensure the discussion is meaningful.

## Facilitating the activity

Divide the participants into small groups and give each participant a copy of the same article. Ask the participants to read the article in 10 minutes and consider the questions at the end of the piece.

On return to the plenary session, facilitate a discussion of the article and the questions posed, focussing on the "real" implications of the issues. Encourage the participants to discuss the issues in relation to your own organization or other aspects of their experience.

# Right Stuff When It Comes To Liveable Cities

***Sydney Morning Herald*, October 21, 2003**

*"A sustainable and liveable city will require sound urban planning, affordable and sustainable buildings, a reduction in car dependency, provision of urban green zones and bushland, clean airways and waterways and energy efficiencies."*

So says a briefing paper put out by the parliamentary inquiry into sustainable cities which has called for submissions by October 31. The inquiry is being held by the House of Representatives standing committee on environment and heritage. The committee has given three examples of the components which make up a sustainable city: a commercial building in Melbourne, an inner-city housing development in Adelaide and a transportation strategy in Vancouver.

The 60L office building in Carlton, developed by the Green Building Partnership, has minimal environmental impact and was built at a similar cost to a less-sustainable commercial building. In comparison to a conventional office building, energy costs are reduced by more than 65% through solar panels; lighting costs by more than 80% through low-energy glass, light wells and an atrium; heating and cooling costs by more than 60% and mains water consumption by 90% by collecting rainwater which is micro-filtered and UV-sterilized for drinking. Carbon dioxide emissions are all but eliminated. It was built with recycled timber, steel and bricks and even the concrete and carpets used mostly recycled contents. Heating and cooling is achieved mainly from thermal mass and a computer maintains even temperatures.

In Adelaide, Christie Walk demonstrates similar concepts in a community housing development on a 2,000 $m^2$ block. The project consists of four linked three-storey townhouses, a three-storey block of six apartments, four stand-alone cottages and a "community house". Timbers are plantation or recycled. Flooring is a compressed straw product equivalent to particle board but without woodchips or formaldehyde. Paving, carports and feature elements use bricks, stone, steel and timber retrieved from pre-existing structures on the site. All concrete in slabs and mass walls contains the maximum percentage of fly-ash, a waste product from power stations which reduces the required amount of new cement.

Each house works as a "thermal flue" allowing controlled release of warm air while drawing in filtered, cooled air from the vegetated, landscaped surroundings. Rooftop gardens provide a thermal buffer to the upper-floor apartments. External and internal walls are made from aerated concrete or other materials which have high thermal and acoustic insulation properties, and dwellings are cross-ventilated. There are no heaters or air conditioners.

Greater Vancouver has high levels of transit use with 117 trips per person a year compared with 63 for the average large American city. The city's transport strategy is based on reducing car access to some areas, slowing traffic in commercial zones, providing interconnecting public-transport systems (including diesel and electric trolley buses, Skytrains and suburban rail systems) and discouraging cars in the city through petrol surcharges and high parking fees.

Urban planning is an important element. Mixed-use medium to high density developments are encouraged along outer transit routes and in urban villages around Skytrain stations and some older high-rise city areas have been "reurbanized" with new transit networks, pedestrian and cycle ways and parks. Vancouver's urban containment policy designates certain land unavailable for urban development. This encourages development at regional centers based around the Skytrain network that enables walking and cycling within station precincts.

## Questions

**Q1** What is the role of partnerships in achieving eco-efficiency?

**Q2** Is there sufficient demand to continue?

**Q3** What role could business play in further developing sustainable communities?

# Bridgestone and Michelin Show Off Fuel-saving Designs – "Unflat" Tires

***Agence France Presse*, October 23, 2003**

Tire giants Bridgestone and Michelin showed off new tires on Thursday that increase fuel efficiency to make driving more eco-friendly, and "unflat" tires that allow motorists to drive without air pressure in their tires. On the second press preview day for the Tokyo Motor Show which opens to the public on Saturday, Japan's leading tire maker Bridgestone unveiled prototype energy-efficient tires that reduce "rolling resistance", which occurs when the weight of a vehicle deforms the tread where the tire meets the road.

Heat generated in this process eventually results in energy loss and reduces fuel efficiency of the vehicle, Bridgestone president Shigeo Watanabe said in a briefing. "So far we had focussed on developing new rubber to reduce rolling resistance. But now we have a new design that does not require any specially created rubber and increases fuel efficiency of the vehicle. We envision this newly designed tire is especially a good fit for electric vehicles to realize maximum emission reduction and eco-friendliness of driving," Watanabe said.

The new tires will be able to be fitted on any wheel, and Bridgestone said in a statement that they would be used in conjunction with a new electric vehicle drive system that uses drive motors installed inside the wheels that it unveiled last month.

Bridgestone's French rival Michelin said meanwhile it was preparing to introduce a new "unflat" tire system, the PAX System, to the Japanese market next year. Motorists can safely drive at 80 kilometers (50 miles) per hour for 200 kilometers (125 miles) with no air in the tires, Michelin Japan Chairman Bernard Delmas told reporters.

"Previously similar systems had problems with tires falling from wheels. But our PAX System is designed so that the weight of the vehicle is always pressuring the edges of tires to make sure they stay on the wheels," he said, speaking in Japanese. Similar unflat tires made by Bridgestone operate for about 80 kilometers with the vehicle running at 80 kilometers per hour, though they can be fitted on any wheels, unlike Michelin's.

## Questions

**Q1** What is the added value in eco-business terms?

**Q2** How or when should a company invest in this type of technology?

**Q3** What kind of innovation is your own company doing in terms of eco-efficiency?

# The Price of Progress

***Sydney Morning Herald,* August 4, 2002**

Environmental scientists are warning that some of the toxic substances used to build PCs, including lead, cadmium, mercury and arsenic, are behind a growing environmental threat – the widespread poisoning of soil and groundwater. And the consequences to our health could be devastating.

The potential for dumped computers and other digital devices to leak toxic substances is one of growing concern at national and international levels, according to the Waste from Electrical and Electronic Equipment (WEEE) report, which was commissioned last year by the South Australian Environment Protection Authority (EPA). Last year 2.2 million computers and notebooks were sold in Australia, many of which replaced obsolete models in homes and businesses, according to the research group IDC. In South Australia alone, it is estimated that 24,000 computers were sent to landfills in 1999.

Computers being dumped outside specially designed landfills pose the greatest threat, says Professor Andrew Nafalski, co-author of the WEEE report. "Most modern landfills have insulation that protects dangerous chemicals from leaking into soil and water," Nafalski says. "But some people will dump PCs in areas that aren't landfill areas and that's where the danger is." The report outlines the seriousness of the environmental disaster. Lead, mercury and cadmium are detrimental to the brain and kidney, and the nervous and reproductive systems, it says. Without a monitored program and high public awareness about the dangers of dumping PCs, Nafalski says the risk of toxic leakage into the environment is growing. "If we don't have a system where we can collect PCs in a planned manner, [the risks] will only increase. It needs to be addressed from the top level down by the Government."

Many PC companies acknowledge the environmental threat and are taking their own steps to lessen the impact of electronics on Australia's environment. Compaq Australia, for example, secured a $73,000 grant from the EPA to establish a take-back and recycling program. For the past 18 months, Compaq's Computer Asset Recovery Service has been collecting and recycling all brands of PCs from the business community. It has also set up a computer monitor recycling plant – a first for Australia – to divert computer components from landfill. So far, 200 tons of computer scraps have been collected and 150 tons processed, with only 7% ending up in landfill. The rest have been reused or recycled. Compaq's service is limited to its corporate customers, because the facilities do not yet exist for consumers to drop off their obsolete PCs within their local community. IBM also recovers computer hardware from business customers, with most of the equipment being refurbished and resold, used internally, donated to charity or offered for sale to employees. The company is also looking to introduce a consumer PC recycling

program in Australia similar to the initiative running in the US, where consumers pay a small fee to have their PCs and hardware recycled or upgraded.

Charity organizations are often the major recipients of obsolete PCs. Computerbank, a non-profit computer recycler, collects old PCs worth hundreds of thousands of dollars from large organizations and upgrades them for low-income people. However, given that most recovery programs are directed at the high-mass corporate sector, and in the absence of standard national PC recycling services, consumers still have limited options. Hopefully, this will change in December, when Australian Government agency Environment Australia and manufacturers will present a nationwide "product stewardship" strategy to the Federal Government which they hope will deliver a "whole-of-life approach to the management of the design, manufacture, distribution, use and wastage of electronic appliances".

David Atkinson, director of the Industrial Ecology Unit at Environment Australia, says the onus is on industry to develop a whole-of-life Product Stewardship program for the recovery and recycling of electronic devices that will be approved by the Government. "The current expectation is that it will be a voluntary program to address issues such as recovery and recycling, and issues of eco-efficiency, with industry setting its own targets and milestones," Atkinson says. Self-regulation may not be the most effective policy, however. In Europe, the US and Japan, the focus of recycling is moving towards a whole-of-life concept called "extended producer responsibility" (EPR), whereby electronics manufacturers become legally and financially responsible for the life-cycle of their products – from design through to recycling and waste disposal. So, not only will companies be responsible for taking back products once consumers have finished with them, but for "green" product design from the outset.

## Questions

**Q1** **Should companies be responsible for the full life-cycle of their products?**

## Questions

**Q2** What is the added value in eco-business terms for the industry to do this?

**Q3** What is the role of government in this area?

## Questions

**Q4** How would legislation on this front affect your company?

**Q5** Could partnerships play a role in informing the public and making companies act?

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 4.0 Debating dilemmas

## Background

Sustainable development can raise complex and controversial issues, often creating a series of dilemmas. Eco-efficiency is also difficult particularly when facing issues "on the ground". There are often no right or wrong answers and sometimes compromises have to be made in order to move forward.

By this stage, most participants will have some understanding of eco-efficiency. It is therefore important to build on that experience, but to recognize that the level of understanding will be different depending on the participant. This activity provides a level of common understanding.

## Purpose & learning objective

During this activity, participants imagine they are in a facility and get to talk to key plant officials and operators (played by the facilitator). Use can be made of different scenarios to let the participants discover a range of key issues and opportunities. These scenarios are based (with embellishments) on real-life situations.

The aims of this activity are to:

- encourage participants to apply some of their learning, and
- enable participants to explore and debate various options.

## Materials

We provide handouts on the following pages for:

- an eco-efficiency assessment strategy, and
- four different scenarios for investigation.

You might also want to prepare additional (or alternative) materials for presenting the *Eco-efficiency assessment strategy* to the group, such as PowerPoint or overhead projector slides.

## Facilitating the activity

1. Present to the group the *Eco-efficiency assessment strategy* (page 113) that will allow the company to investigate and prioritize eco-efficiency opportunities.
2. Divide the participants into small groups and give each group a scenario to read through. Groups can work on the same or different scenarios.
3. Encourage the groups to consider who the stakeholders will be and who they should consult when grappling with their dilemma.
4. Encourage the group to ask questions that will bring out potential eco-efficiency opportunities for each level of the hierarchy, starting at the bottom of the triangle (see the diagram in the first handout) and working up. This is to reinforce the process of using the waste management hierarchy to find opportunities at all levels. The highest cost savings come with the highest-level projects.
5. In a follow-up discussion after the role-playing exercise, pull out questions and opportunities and get a discussion going on what would keep the participants from taking the same approach at their own locations. Have them share advice on getting through these barriers.

6 Finally, have them prepare an action plan sheet listing several things they will investigate when they get back to their locations, who they need to talk to and work with, who could help them and serve as mentors or coaches, time schedules, etc.

## Guide notes for role-players

*Scenario 1: Great cans, poor profits*
Internal stakeholders include: plant manager, accounting head, process engineer, die operator, maintenance person, product designer.

External stakeholders include: customers, government representatives.

Potential opportunities include:
- Die layout (alternating pattern).
- Quality – more frequent die maintenance to improve quality, better lubricant to give higher quality and increased tool life. Should look at cost impact of going to the highest-quality lubricant available (not just going back to the one they used to use).
- Alternative can material – lowest cost, most recyclable.
- Thinner walled material – reduce the amount of metal in each can.
- Importance of uniformity of raw material quality.

*Scenario 2: New coat, new problems*
Internal stakeholders include: window frame designers, quality control personnel, boiler operators and then environmental officer reporting emissions to government agencies.

External stakeholders include: government environment agency with mandate on boiler emissions, customers of window frames.

Potential opportunities include:
- Making a new product out of the new mixed waste, a company currently makes window frames out of an extruded mix of ground-up wood and plastic with greatly increased product quality – it has turned into their most profitable product.
- But the process must change to reduce scrap rates – do a root-cause review. The plant manager's response is that they know that if they buy new equipment they can do this, but they do not have capital and the returns do not justify the cost. They are already challenged in trying to make the new wonder product using very old manufacturing equipment, but have been told that if they complain the owners will just close their plant and build a new one in a neighboring country where labor costs are cheaper.
- Grinding up and separating the plastic from the wood. This is the least practical option but is the first one the plant would look at when the engineers are asked to come up with a solution to the problem – after they find out that upgrading the boiler is too costly.

- You want the group to ask questions of the cost accountant and product designer on the economic viability of the new product – why did they switch and did they realize the total cost before they went down this path? (They did not, since the environmental person was not involved in the product design process.) What good would asking questions at this late date do? The change in product is done. We would suggest saying – do a review to determine if it is viable to go back to the old windows, based on the considerations for moving to new windows and customer satisfaction. If they go back to the old windows, however, is the problem solved, as the boiler has already been damaged? If you stick with the new, then one of the above scenarios must be chosen as complementary. Maybe this should be the starting point?

*Scenario 3: The paint threat*
Internal stakeholders include: plant manager, safety manager, accounting head, process engineer, operator, maintenance person and product designer.

External stakeholders include: government, plant inspectors, medical services.

Potential opportunities include:
- In-line mixing of product instead of tank-based mixing (eliminate the tanks).
- Latex (water-based) paint and water clean-up.
- Start the week with light colors, moving to darker as the week goes on.
- Reusing dirty solvent for an initial wash and finish with clean solvent.
- Reuse the cleaning solvent in the product.
- Educate employees on potential risks.

*Scenario 4: Rush to market*
Internal stakeholders include: corporate environment, safety and health (ESH) manager (who just found out about the product when someone on the product design team asked if there were any environmental issues they need to be aware of, so they can dispose of the excess/waste coating, which contains shark fins, berries from the rainforest and other rare ingredients), product designers, marketing team, production team, management.

External stakeholders include: health department, fisheries department, WWF, the people in charge of the rainforests, NASA.

Potential opportunities include:
- Develop alternatives to using natural resources (e.g. replace shark fins with artificial ones, grow your own moon rock, grow the Amazon berries in a greenhouse).
- Create a consultancy group to debate the questions posed by this new device.
- Form a partnership with NGOs to get advice in production and pricing.
- Involve the ESH manager and the production manager from the outset.
- Educate the design team on SD and ask them to come up with alternatives.

# Eco-efficiency assessment strategy

This strategy is meant to help identify, investigate and prioritize eco-efficiency opportunities.

1. Can the pollutant generating process be eliminated without a negative effect on the product, for example by eliminating unnecessary cleaning steps during processing?

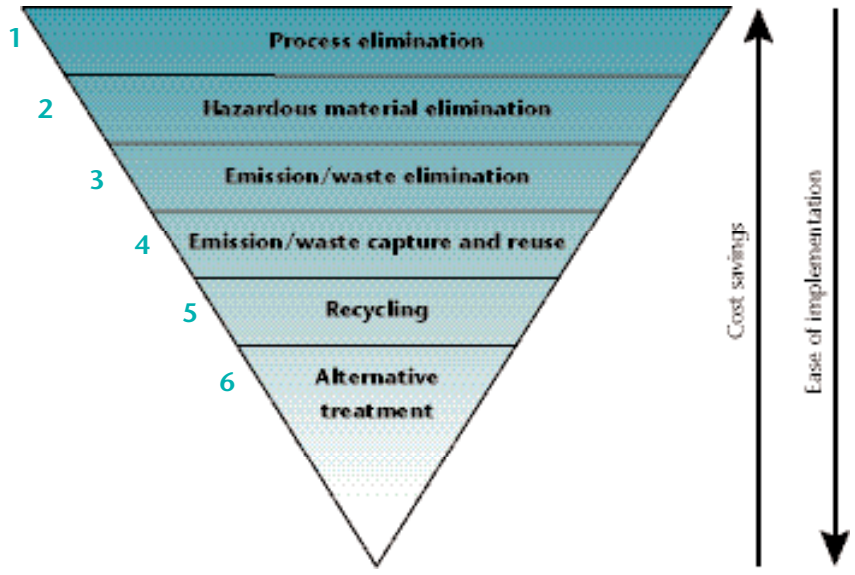
2. Can the hazardous materials used in the process be eliminated or replaced with a non-toxic or less toxic material – for example, by replacing organic solvent cleaning with water-based cleaning systems, or replacing spray lacquer paints with powder coatings?

3. Can non-product outputs (waste or emissions) be eliminated from the process? An example of this would include improved quality control to reduce reject disposal costs.

4. Investigate the opportunities for waste or emission capture and reuse within the process, such as using a coolant recycling system for metalworking fluids.

5. Investigate the recycling opportunities, for example the shipping of spent solvents off-site for distillation and then subsequent re-use.

6. Investigate alternative treatment methods, such as those to reduce the volume or toxicity of the wastes or emissions.



# Scenario 1:

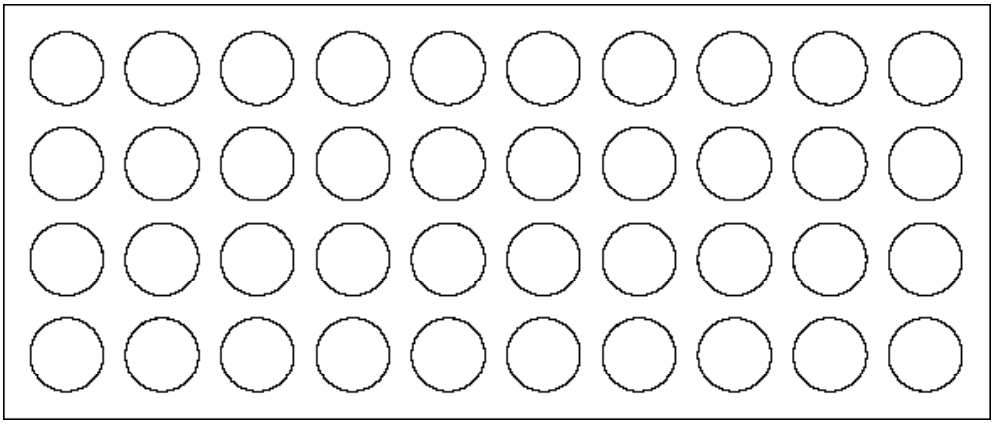
## Great cans, poor profits

Your company makes beverage cans by cutting circles out of a sheet of raw material and then extruding it through a die to make the can.

The company is a great place to work, with positive-thinking employees who are totally committed to the company. There is a great scrap-recycling program, and a portion of the proceeds from the recycling of the scrap metal goes to an employee morale fund. As a result, employees have excellent quarterly parties and starting this year they are going to include live bands.

The plant manager enjoys his work since his bonus is tied to the cost recovery from the scrap metal recycling program – although he is getting pressure from the owners to fix the dwindling profits. He has not yet linked the increase in scrap generation to his plant's profitability. As profitability was down slightly he laid off some of the maintenance department six months ago. Profits improved a bit but now seem to be back down.

The original increase in scrap was tied to switching to a lower cost extrusion lubricant for the extrusion process. What next steps do you recommend?



**The die layout**

# Scenario 2:

## New coat, new problems

Your company is a producer of high-quality window frames that are painted before being sold. As a result of the plant's particularly high standards, many windows do not pass quality control and are ground-up and burned for fuel in an old boiler at the plant.

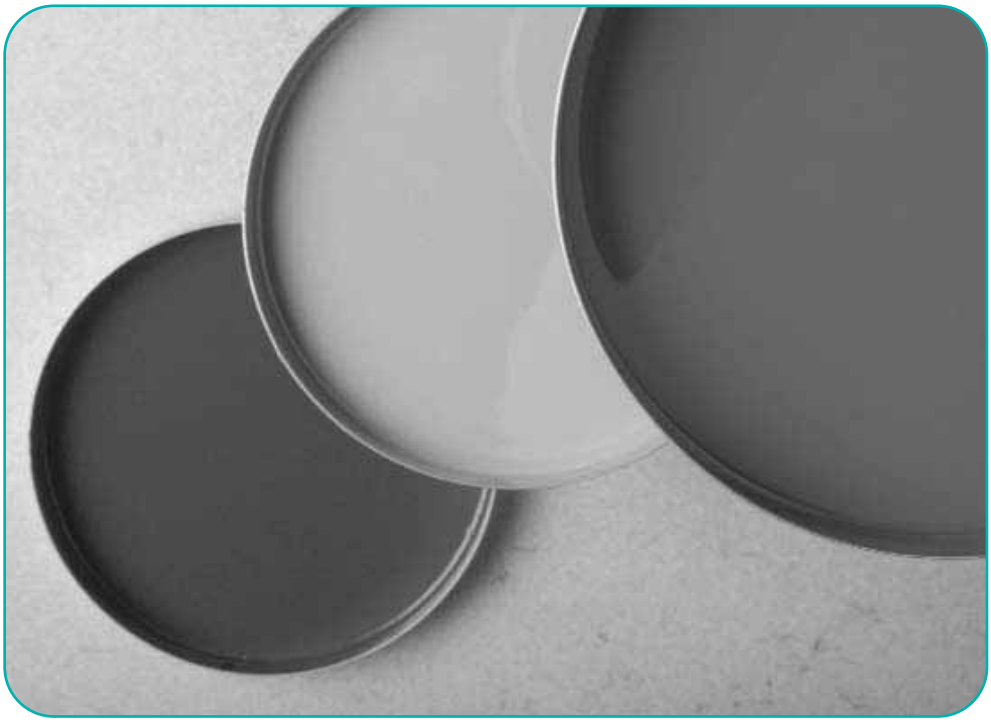
The company has recently introduced a new product containing a PVC plastic coating that replaces the painted product, an innovation that your customers love. However, as the plastic adheres tightly to the wood, it cannot be easily separated and is now in the wood waste for the boiler, creating problems with production line waste management.

The plant must buy a new boiler with an acid gas scrubber and baghouse and made of more chemically resistant materials, because the environmental agency has noticed the increase in emissions from the old boiler and the HCI emissions from the plastic that is now on the waste.

The cost of replacing the boiler is very high and the plant does not have the necessary money to invest in the change. HCI emissions from burning the plastic also are starting to damage the current boiler. What should you do?

# Scenario 3:

## The paint threat



You work for a solvent-based paint manufacturer, headquartered in France with operations in 25 countries, with 15,000 employees and a turnover of $1,956 million a year.

Solvents are used to dissolve the "binder" and develop the correct consistency for application when mixing paints. Ingredients are weighed and added to big tanks where they are mixed and subsequently transferred into drums or smaller containers. After each batch the tanks are washed down with solvent. Before light colors are done, someone must actually go into a tank to thoroughly scrape it clean, which can be dangerous if done before it has been adequately vented.

As a result of an accident where two employees entered a tank before it had been adequately vented and collapsed, the government is requiring the company to purchase a supplied air system that each employee must wear when cleaning a tank. They are also requiring that a hoist be in place in order to pull out any employees that collapse. These two procedures are very resource-intensive, but the company – and the plant manager in particular – must comply with the new legislation or face serious sanctions.

The waste that is removed when cleaning the tanks is used for fuel, therefore it does not need to be disposed of and doesn't represent an environmental concern.

# Scenario 4:

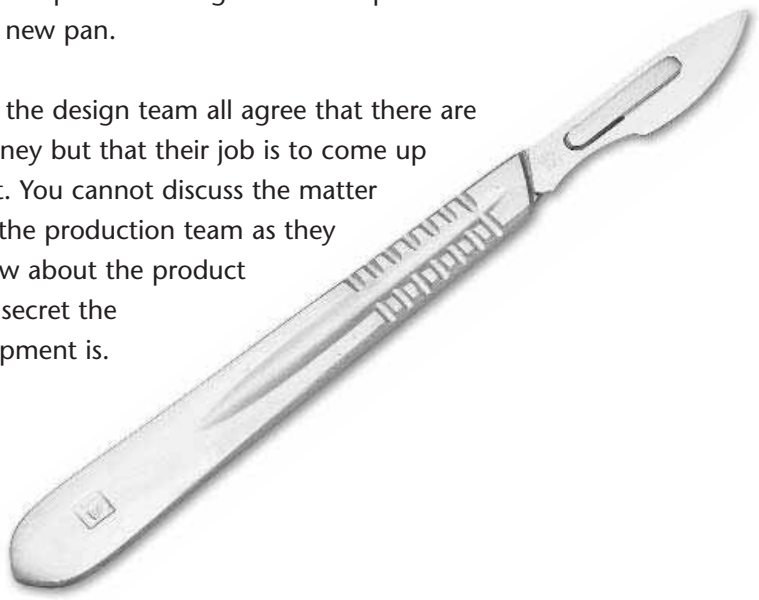
## Rush to market

A new implanted medical device with a very expensive coating is being introduced and the first company to market it will make a lot of money. The primary objective of the product design team is therefore to get the product to market, but before selling it they must have it approved by the health department.

The medical device is so revolutionary that the company will be able to sell it for almost any price and the coating they are using and the only one they have tested is made from shark fins and moon rock blended with the berries from a rare tree that grows in the Amazon rain forest.

Current production techniques require that small batches of the product be placed in a basket that would then be dipped into a pan of the coating mixture. After each batch the pan of coating must be disposed of and a new batch made in a new pan.

The members of the design team all agree that there are ways to save money but that their job is to come up with the product. You cannot discuss the matter with anyone on the production team as they do not even know about the product yet – that's how secret the product's development is.



# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 5.0 Eco-innovation

"Human rights and the environment can be defended in a very direct way through the individual conduct of each and every business."
Kofi Annan, Secretary-General of the United Nations

## Background

The focus has moved from the operational aspects of eco-efficiency toward eco-innovation and design for environment. This has opened up even bigger opportunities for companies to advance their eco-efficiency performance. For many companies, the main effects on the environment actually occurred outside their fence-lines – either upstream in the raw material generation and supplier processing phases, or downstream in the product use or disposal phases.

The OECD identified innovation as the key driver for improving eco-efficiency and said that it was best stimulated by strong competition, high factor prices, regulatory incentives, an effective process of disseminating "best practice", and the presence of a good climate for innovation. What is needed now are radical improvements, better product design and further adoption of eco-efficient principles.

## Purpose & learning objective

This is a useful innovation activity in helping people to think differently and to work cross-functionally. The technique is called **systemic inventive thinking**. You begin by listing the essential elements of a product, both its physical components and its attributes, such as color and expected useful life. You also look at the product's immediate environment, again identifying both its physical components and its attributes. Then you manipulate these elements to come up with something new, following one or more of four generic innovation patterns.[1]

## Materials

We provide handouts on the following pages for:

- explanations of the four generic innovation patterns
- six examples of innovative thinking, for discussion before or afterwards.

## Facilitating the activity

You might want to use the real-life examples either to raise interest before the activity, or to provide a focus for a concluding discussion.

For the main activity:

- Ask participants to find a partner and decide upon a consumer product. This can be something your company produces or just an everyday product you use such as a watch, TV, CD, bottle of champagne or bag.
- Invite participants to consider the four generic innovation patterns and apply one or all of them to the product. For example, consider what you can subtract to make the product more eco-efficient.
- Examples are provided to stimulate thinking or as follow-up reading.

[1] This tool has been developed from: Goldenburg, J., Horowitz, R., Levav, A., Mazursky, D., "Finding your Innovation Sweet Spot", *Harvard Business Review*, March 2003.

# The four generic innovation patterns

## Subtraction

In developing new products, people intuitively tend to add features to an existing product. While it is a logical approach, products may become complicated and complex. Instead, try to remove a component or attribute, even those that seem either disagreeable or indispensable. For example, taking out the lead in petrol or the sugar in soft drinks.

In discussion with your partner, do something to your product to ruin it. Either a design flaw, material flaw or use flaw – just ruin it. For example, scratch the CD, make the champagne flat or take the hand off the watch. Re-invent or reverse invent the flawed product, improving its environmental impact.

## Multiplication

Multiplication involves making one or more copies of an existing product component and altering those copies in some way to improve product quality. A classic example is the "Gillette Double-Bladed Razor". The extra blade is a multiplication because it represents an extra blade but it is set at a different angle. How can the multiplication process help stimulate new, environmentally friendly products?

## Division

By dividing an existing product into its component parts, you may be able to see something that was an integrated whole in an entirely different light. You may then be able to reconfigure those parts in unanticipated ways. For example, stereos are often sold in individual parts to allow for customization rather than in an integrated system. Think of a product and how its component parts can help with new processes or create by-product synergies.

## Task unification

You can often realize significant product innovation by assigning a new task to an existing element of the product or its environment, thereby unifying two tasks in a single component. An example of this approach involves unifying the defrosting filament with radio reception to get rid of the separate radio antenna. How about reaching new markets?

This tool has been developed from "Finding your Innovation Sweet Spot" by Jacob Goldenburg, Roni Horowitz, Amnon Levav, David Mazursky, *Harvard Business Review,* March 2003.

# Innovation example 1

## Sony: Innovations for the product use phase

Sony is taking a holistic approach to enhancing products and services to minimize environmental impacts. Innovations are not only improving production, but also reducing environmental impacts in the products' use phase. This has led to the development of a number of technologies that help reduce the environmental impact attributed to consumer behavior during product use, service and disposal.

Life-cycle assessment points out that the major ecological burden of electronic products is due to the energy consumed in the use phase of the product life. European home consumer electronics consume 36 TWh (terawatt-hours) and are forecasted to grow to 62 TWh by 2010. Sony's SDM-N50 liquid crystal display incorporates a unique set of user features that directly reduces the energy consumption of the product. The 12 mm, 3 kg display features an energy saving infrared "user sensor" and an ambient light sensor. The user sensor automatically switches the screen to sleep mode (of a rate of less than 3 watts) if no one is sitting in front of the screen. The light sensor adjusts the brightness (and therefore energy consumption) of the display according to the natural ambient light conditions of the room.

Sony is also developing technologies and services that contribute to the extension of product lifetime. For example, the ProGlobe television is a European prototype design aimed at establishing technologies for improved serviceability. The prototype technologies being developed include a unique chassis design that allows service engineers to access the internal core of the TV at the consumer's home (potentially reducing the travel burden and cost of TV service) and a one-click, "eco-mode" function giving the user the option of reducing the operational energy consumption of the TV by 25 watts (by adjusting the picture brightness). In addition, the ProGlobe's new power circuit layout provides a remarkably low level of 0.5 watt stand-by power consumption.

Miniaturization and the shift to digital technologies have made product repair an increasingly difficult and specialized job. In Europe, Sony has introduced the "exchange and refurbishing program", an innovative service concept for the efficient repair of products with large sales volumes, such as the Walkman, Discman, PlayStation and mobile phones. In the case of a defect, a customer can exchange their product at the dealer for a refurbished model, or even for a new one (if a defect is found within the three-month guarantee period from purchase). Defect products are collected and refurbished, broken parts are repaired or exchanged, and housing parts are checked at a central European location. Since factory-like repair is more efficient, average costs have been reduced by 25%. This way, more product parts and components get the chance of a second life. For example, Sony is achieving a 68% reuse rate for the plastic components of returned PlayStations. Virtually all of the remaining components that cannot be reused are recycled.

www.sony-europe.com/head/environment.html

# Innovation example 2

## Dow: Innovation in service instead of product

Due to their cleaning efficiency, chlorinated solvents are used in a variety of industries, including pharmaceuticals, plastics, dry-cleaning, and metalworking. They are also used for the production of everyday items such as the Swiss Army Knife. In some cases, especially high-tech applications, chlorinated solvents are irreplaceable. However, in the mid-1980s new information about the potential hazards associated with the use of these solvents became available. Thus regulatory authorities had some difficult decisions to make. Some countries chose to heavily restrict the use of these solvents. Invariably, this led to the development of substitutes, but many of these substitutes were untested products that were not necessarily safer.

However, the three main chlorinated solvents that were on the market had been subjected to extensive health studies and toxicological reviews. Consequently, their health profiles were well known, and effective safety procedures could be adopted. Germany chose not to ban the use of chlorinated solvents, but rather to require that their use take place in a closed-loop system. Convinced of the advantages offered by these products, The Dow Chemical Company remained in the chlorinated solvents business. The company was also confident that managing the risks would provide a better, safer option than turning to insufficiently tested alternatives with unknown risks – following the principles of "Responsible Care". Dow began exploring new business models that would provide users with an environmentally and economically sound product in a safe and reliable manner.

In 1992, Dow Deutschland Inc. and RCN (Recycling Chemie Niederrhein) founded a joint venture to offer chlorinated solvents in a closed-loop delivery system accompanied by support service. The new system offered not only the safe delivery and take back of solvents but also assistance to customers in the use of these solvents in closed-loop equipment. The company was called SAFECHEM Umweltservice GmbH and became a fully owned subsidiary of Dow Deutschland Inc. in 1998.

Today SAFECHEM markets the SAFE-TAINER System across Europe. The system centers on two specially designed double-skinned containers (one for fresh solvent and one for used) and each has an integrated drum for the solvent. This is intended to give protection against accidental damage, discharge, and spillage. The offering, however, comprises far more than just safe containers; the SAFE-TAINER System is an entirely new business model whose success is founded on two considerations: ecological and economic sustainability.

With the implementation of closed-loop systems, solvent consumption has dropped considerably, due to the reduction in emissions. The solvent remains for extended periods (a year and more) in the closed cleaning equipment. The goal of this approach is to use the solvent for as long as possible in a recycling loop at the customer's site prior to external recycling. SAFECHEM is a service-focussed business, selling minimum solvents and maximum support services to allow the customers to achieve goals. SAFECHEM and Dow offer this service platform in Germany, Switzerland, Austria, Italy, Spain, France, the UK, Sweden, Benelux and Portugal. It is thanks to the legislative development favoring the use of chlorinated solvents in closed loops, rather than their prohibition, that the idea of SAFECHEM as service and solution provider has proved such a significant success in Europe.

www.dow.com/safeche

# Innovation example 3

**Dow: Innovation in production and raw materials**

Dow announced recently that it would begin making alternative products that will compete against traditional wood-based products. The company acquired a majority of the assets of Isobord Enterprises, Inc., and will produce engineered composite panels made from waste wheat straw and Dow's polyurethane resin. The product will be marketed under the name WOODSTALK and can be used for kitchen counters, shelving, ready-to-assemble furniture, cabinets, door cores and floor underlay.

"These composite panels provide an environmental benefit to consumers since they are made from an annually renewable resource and have the performance characteristics of traditional wood-based panels. Using straw for such panels reduces the need to burn it in the fields, which creates air pollution. This product fits well with Dow's commitment to sustainable development," according to Brad Money, general manager and president of Dow BioProducts.

Adds Money: "Consumers increasingly are looking for products that reduce the environmental impact. Woodstalk products do just that by utilizing the annually renewable residual wheat straw. Woodstalk has potentially a strong commercial appeal for consumers and contractors."

Through many outlets in North America, home-improvement retailer Home Depot distributes the Woodstalk products. Says Ron Jarvis, Home Depot's Lumber VP of Merchandising: "We believe Dow's resources, know-how and reputation will be a strong factor in bringing environmentally conserving wood replacement panels more into the mainstream with consumers." By buying an existing, modern manufacturing facility whose employees have the know-how and expertise in producing these panels, the company avoided "having to build from scratch in a green field situation," says Money. Dow's expertise in process technology and polyurethane binders combined with that of the existing workforce in composite board production creates an ideal environment for improving and developing the business. The proof is in the paneling. These products have received several environmental awards, including the Sustainable Development Award of Excellence from the Manitoba Round Table and the Salute to Clean Air Industry award from the Manitoba Lung Association. Saving trees – and lungs – is a winning combination.

Dow BioProducts Ltd., a wholly owned subsidiary of Dow Chemical Canada Inc., www.dow.com/dow_news/prodbus/2001/20010914a_pb.html

# Innovation example 4

### Housing design: Using an opportunity

A designer in the Netherlands who wanted to save space in a housing project joined a sink and toilet at the hip and stumbled upon a simple design that could save thousands of gallons of water. Not bad when you consider that, by the year 2020, two-thirds of the world's people will live in a water-starved area.

For one design engineer, the answer came in using one process' waste to power a related but still very different process. The designer had created a shared structure for a bathroom sink and a toilet, which was originally designed as a space-saving feature. In looking at what he had created, he saw the opportunity to reduce the amount of household water needed. Some 30% of household water used is literally flushed down the toilet.

With a few modifications to the design, the water from the sink was collected in a reservoir and subsequently used in the toilet in place of the fresh clean water. This reuse of so-called "gray water" saved significant amounts of water and reduced the amount of water that entered sewage treatment plants.

# Innovation example 5

### SoftAir™: design for fewer resources

SoftAir™ rethinks furniture design – a new technique to utilize an inexhaustible, 100% eco-friendly and absolutely free natural resource: air! The SoftAir™ furniture is based on a soft, environmentally adapted, high-tech plastic material and a new manufacturing technique. Together they form the fundament of SoftAir Technology (pat. pend. int.).

One way to improve our prospects is to manufacture only products that require few resources, are renewable, biodegradable and can be dismantled and sorted for recycling. To manufacture a SoftAir™ sofa you need only about 15% of the materials, energy and production resources required to make a traditional sofa. The savings become even greater when you look at transportation and storage. It all adds up to a reduction of 85% of the total amount of energy consumed by a sofa during its lifetime.

The soft plastic at the heart of the SoftAir™ furniture is one of the purest plastics there is. Polyolefin is 100% recyclable. In the event of fire it produces no toxic fumes. It burns in a slow and subdued fashion and generates little smoke.

The entire collection is carefully tested both concerning quality and function. Recycling is often a complex and costly process. For SoftAir™, however, this cost is negligible.

www.softair-furniture.com

# Innovation example 6

### Ford and DuPont: Creative cooperation

An intriguing example is an arrangement by Ford and DuPont in the European market.

Traditionally, DuPont was happy to sell Ford all the paint it could in connection with Ford's vehicle painting operations. In a unique arrangement, Ford contracted with DuPont to come to its plant and directly paint the vehicles.

This aligned the needs of both the customer and the supplier – to use as little paint as possible and thus reduce the impact of the product and the process on the environment. Cooperative arrangements like this demonstrate the creativity inherent in the need for eco-innovation.

www.greenmarketing.com/gemipreconference.pdf

# Note pad & worksheet

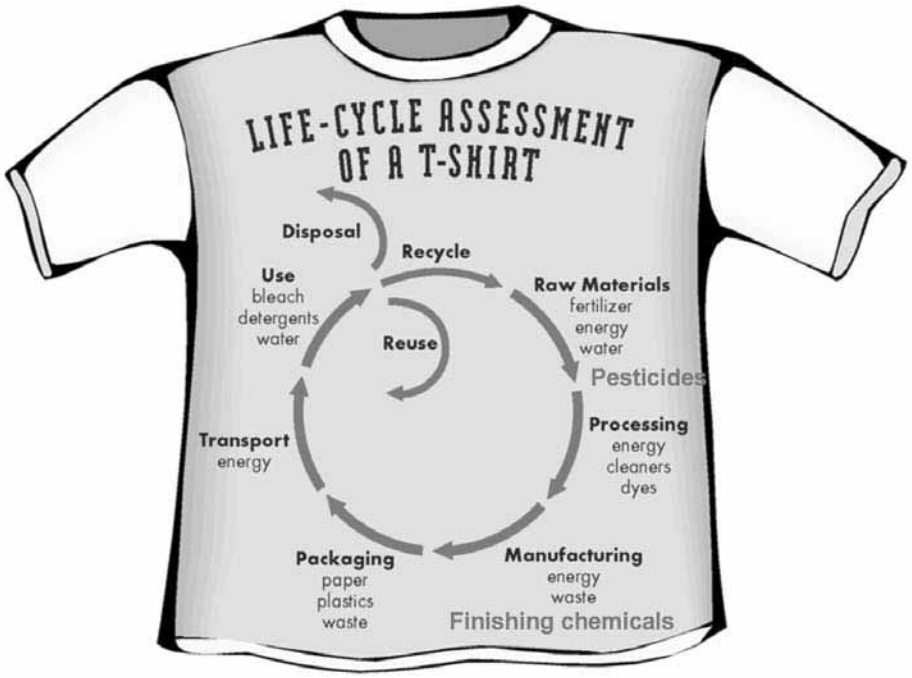
Use this space for your notes and ideas

Lessons and take-away messages

# 6.0 Negotiating a contract for supply

## Background

As indicated early in this module, opportunities for making products and services more eco-efficient are not limited to within a company's boundaries, such as manufacturing and plant management. These opportunities are just as valid for the entire supply and production value-chains. Often, harmful impacts – from waste or ineffective use of material and energy – are found in the way raw materials are generated, processed or transported to the company's gate.




This graphic, courtesy of the Worldwatch Institute[1], shows some of the environmental effects of supplying goods to a t-shirt manufacturer. The manufacturer directly purchases processed cotton, energy, water and finishing chemicals, as well as t-shirt packages, transport and labor. In turn, each of those suppliers has a network of suppliers from whom they purchase fertilizers, dyes, plastics and paper and fuel.

*Supply Chain Environmental Management involves the organization of activities to address the environmental performance of material, components, goods and services that an organization buys and uses.*[2]

[1] Worldwatch Institute, Worldwatch Paper 166: *Purchasing Power: Harnessing Institutional Procurement for People and the Planet*, July 2003, www.worldwatch.org.
[2] Pollution Probe, 2003. *Environmental sustainability concepts and tools.*

## Purpose & learning objectives

The purpose of this role-play activity is to help participants discover how some of the eco-efficient options they have learned about may factor into a typical business activity – purchasing. The intent is to learn, by role-play and by hearing from others, about the eco-efficient options in the supply chain and how to capture them.

This activity has four roles. Participants work in teams of two to negotiate with another team of two on a purchasing contract for a particular chemical. The first team is from a company called Chemical Supplier Inc., with one person playing the marketing & sales role and one playing the role of product developer. The second team is from a company called Shampoo Maker GmbH, with one person playing the procurement role and one the product developer role. Each of the four roles has different information, so each twosome must work together to negotiate the terms of a contract agreement that satisfies both companies.

Shampoo Maker GmbH currently purchases a chemical called e.d. from Chemical Supplier Inc., as a key additive in several of its main shampoo products. For various reasons (apparent in the role card), Shampoo Maker GmbH is considering removing chemical e.d. from its shampoos at some point in the future.

Using the limited information provided on their role card, the groups may come to an agreement on what to do, how to accomplish it and who pays for what. In other cases, the groups may come to a stalemate. At the end of the exercise ask the groups to share their experience with the entire group.

## Contact for questions

If you have questions about using or adapting this activity, contact Kevin Brady at Five Winds International (k.brady@fivewinds.com, +1 613 722 6629).

## Materials

Use the role cards and note pad provided on the following pages.

## Facilitating the activities

The activity should take no more than one hour.

Before you begin:

1) read the information given for all four roles so you understand the negotiating positions
2) brainstorm various eco-efficient options for the contract so you will be able to prompt groups that may get stuck – see suggestions in the Facilitator Notes (print, read and keep the Facilitator Notes with you during the activity).

To conduct the activity, divide participants into teams of four. Hand out the role cards so each person in each team of four has a different role: that is, each team should have one marketing person and one product development person from Chemical Supplier Inc., and one procurement person and one product

development person from Shampoo Maker GmbH. Tell the two people with roles from Chemical Supplier Inc. that they are partners from that company. Likewise, the two people with Shampoo Maker GmbH roles are partners.

Give each person time to read the information on their role card (5 minutes).

Explain the activity to the entire group and emphasize there is no "correct" outcome – a stalemate is possible. Tell participants the information on each role card is different, so it is important for them to ask questions, especially of their colleague/partner from their own company. Also encourage participants to be creative and use their imaginations to go beyond the information provided. Explain that following the activity, the group will come back together and have a chance to ask questions of the other teams and raise interesting lessons from their negotiation (5 minutes).

Ask each person to pair up with their partner. Give them time together (10 minutes) to discuss their company's interests, objectives and ideas for negotiating the contract.

Now, set each team of four to work negotiating a contract between Chemical Supplier Inc. and Shampoo Maker GmbH. Circulate among the groups, listen in, provide guidance and answer questions (20 minutes).

Bring the teams together. Ask each group to share something from their experience with the entire group. For instance, what were the terms of their contract? Did they get stuck and, if so, why? What innovative ideas did they come up with? What eco-efficient ideas did they come up with? What did they learn about looking for eco-efficient alternatives that lay beyond the direct control of their own company? (20 minutes).

# Facilitator notes for reference

Some insights into the two companies (be sure to also read the information given for all four roles, on the following pages):

**Chemical Supplier Inc.**

Chemical Supplier Inc. does not see a clear incentive to introduce the substitute chemical or to eliminate chemical e.d. This is because its profits from chemical e.d. are high, its current market position is strong and no other customers are asking for the substitute. In fact, it sees risk in investing in capital to produce the substitute chemical because it knows less about its production and life-cycle performance – even though it is more benign and effective in smaller doses.

**Shampoo Maker GmbH**

Shampoo Maker GmbH wants to eliminate chemical e.d. from its ingredients list. However, it very much wants to keep Chemical Supplier Inc. as a supplier, because of its reputation and consistent quality. Moving to a new supplier would entail potential risk and would require money for screening, selection, auditing. So, Shampoo Maker GmbH would rather offer incentives to help Chemical Supplier Inc. introduce the substitute chemical to the market.

Now consider the potential outcomes and contract terms below, to help you prompt groups during the activity:

- Shampoo Maker GmbH offers to work with Chemical Supplier Inc. on a life-cycle assessment study of a new substitute chemical. Both companies use the results to compare the environmental, life-cycle impacts of chemical e.d. to those of the substitute chemical. Shampoo Maker GmbH also uses the results to better understand the environmental impacts of its shampoos overall. Chemical Supplier Inc. uses the results to improve its chemical, or to market the substitute chemical to other customers as a more eco-efficient alternative.
- The contract allows Shampoo Maker GmbH a fixed period of time to exclusively use the substitute chemical. At the end of that period, Chemical Supplier Inc. can actively market the substitute to other companies. This gives Shampoo Maker GmbH enough time to get payback from being first on the market with an “endocrine disruptor free” shampoo. It also will later give Chemical Supplier Inc. opportunity to grow its market and capitalize on the investment it made to switch from chemical e.d. to the substitute chemical by selling to other customers. Shampoo Maker GmbH may point out to Chemical Supplier Inc. that once it launches its “endocrine disruptor free” shampoo, other shampoo makers will be looking for chemicals free from endocrine disruptors – the market will grow and Chemical Supplier Inc. will be ready to respond to that market demand, ahead of its competitors.

- Chemical Supplier Inc. signs an agreement to take back all drums in which the substitute chemical is shipped, as the facilities are only 32 kilometers apart. This provides an additional stream of revenue for Chemical Supplier Inc. (having dealt with chemicals similar to the substitute, it has equipment and expertise to clean the drums effectively). This arrangement also saves Chemical Supplier Inc. money from not buying new drums, and it further secures a relationship with Shampoo Maker GmbH by giving them more time to interact with their customer. It also positions Chemical Supplier Inc. to compete with its own competitors on more than price, by offering customers its technical expertise in addition to straight product. The arrangement saves Shampoo Maker GmbH money by not having to clean and store empty drums. Because Shampoo Maker GmbH communicated its drum recycling in its annual report to strengthen its reputation, Shampoo Maker GmbH may now want to write about its "drum re-use initiative" with Chemical Supplier Inc., resulting in good publicity for both.

# Role One – Marketing & Sales Professional from Chemical Supplier Inc.

**Your aim**

Your aim is to negotiate the terms of another contract to supply your long-time customer Shampoo Maker GmbH with a chemical, called chemical e.d., which it uses to produce shampoos. You are working together with your colleague, a Product Development Professional, to negotiate the new contract.

**Your company, Chemical Supplier Inc.**

Your company formulates chemical materials used in a range of industries, from paints to water-treatment to personal care products such as shampoos.

The personal care market is your largest, in terms of revenue (not volume) and you have nine major customers in this market. All of these customers purchase a chemical from you called chemical e.d., which is used in shampoo.

One of your customers is a company called Shampoo Maker GmbH. Its main manufacturing facilities are located 32 kilometers from your own facilities.

**Chemical e.d.**

You have been making chemical e.d. for shampoos for more than 12 years. You know the process well and have made it very efficient regarding the use of raw materials, energy, water and wastes.

Thus, you typically out-compete your competitors and have a strong market share. There are several competitors who also make this chemical and you compete with them strictly on price, given the current market and customer interest.

**Substitute chemical**

Your company's Research and Development group has developed a substitute for chemical e.d. However, this substitute has never been commercialized or introduced to the market, due to lack of demand. Customers are happy with the performance of chemical e.d. and, given your efficient production, it is a money maker for your company to date.

**Environmental awareness**

More broadly, your company is certified to the ISO 9000 quality standard. You have a solid reputation for complying with regulations, including environmental regulations, permits for air and effluent emissions and occupational health and safety standards.

You have heard about life-cycle assessment, and this notion of looking beyond your own processes to better understand the environmental impacts of the raw materials you use as well as the fate of your chemicals in the environment, after they leave your customer's gate. But you do not currently have the money, time or other resources to do this for any of your current, or new, chemical products.

# Role Two – Product Development Professional from Chemical Supplier Inc.

**Your aim**

Your aim is to provide technical advice to your colleague in negotiating terms of another contract to supply your long-time customer, Shampoo Maker GmbH, with a chemical it uses to produce shampoos. You are working together with your colleague, a Marketing & Sales Professional, to negotiate the new contract.

**Your company, Chemical Supplier Inc.**

Your company formulates chemical materials used in a range of industries, from paints to water-treatment to personal care products such as shampoos.

Specifically, you produce a chemical used in shampoos called chemical e.d. You ship chemical e.d. to customers in plastic drums, which the customers simply rinse out and send away to recyclers.

**Chemical e.d.**

You have been making chemical e.d. for shampoos for more than 12 years. You know the process well and have made it very efficient regarding the use of raw materials, energy, water and wastes.

**Substitute chemical**

Your company's Research and Development group has developed a substitute for chemical e.d.. It is equally effective and smaller amounts are required to achieve the same performance. Also, it is a more benign chemical, free from ingredients thought to be persistent, bioaccumulative, toxic, or suspected to disrupt endocrine function in animals. However, this substitute has never been commercialized or introduced to the market. There are currently no regulations on the existing chemical e.d. You expect it will be costly to have the substitute tested and approved – by the Government and in customers' processes. Moreover, product development is focused on emerging new products – not chemical e.d., which is a longstanding, consistent success with customers. Substituting it might lend credence to speculation and media hype about endocrine disruptors, which is not based on scientific evidence.

Also, you know less about whether you can manufacture the substitute as efficiently as you currently manufacture chemical e.d.

Another difference is that the drums used to ship the substitute chemical require different cleaning detergents, equipment and technical expertise than are currently used to clean chemical e.d. from the drums (i.e. which the customer must do before sending the drums away for recycling).

**Environmental awareness**

You have heard about life-cycle assessment, and this notion of looking beyond your own processes to better understand the environmental impacts of the raw materials you use as well as the fate of your chemicals in the environment, after they leave your customer's gate. But you do not currently have the money, time or other resources to do this for any of your current, or new, chemical products. You question the value this will add to product development.

# Role Three – Procurement Professional from Shampoo Maker GmbH

**Your aim**

Your aim is to negotiate the terms of another contract with your supplier Chemical Supplier Inc. for a chemical you use to produce shampoos, called chemical e.d. You need chemical e.d. today, but at some point you would like to phase-out your use of chemical e.d. in shampoos, because there is suspicion that it may disrupt endocrine function. You see market advantage in being the first to have "endocrine disruptor free" on your shampoo bottle. You are working together with your colleague, a Product Development Professional, to negotiate the new contract.

**Your company, Shampoo Maker GmbH**

Your company, Shampoo Maker GmbH, makes shampoo, moisturizing lotions and other products for the personal care market.

You purchase a chemical called chemical e.d. from a company called Chemical Supplier Inc. It is currently a key ingredient in your shampoos.

You currently recycle the drums in which the chemical is shipped to you. You highlight this recycling effort in your annual environmental report because you feel it is important to your reputation.

**Chemical e.d.**

Chemical Supplier Inc. has a good reputation and has proven consistent and reliable in all the chemicals it has supplied you with over the years. Chemical Supplier Inc. consistently meets your quality and safety standards and only requires infrequent auditing.

You could purchase the same ingredient – chemical e.d. – from another supplier, but the other suppliers do not have the same reputation and are located further away.

Chemicals suspected to disrupt endocrine systems are currently receiving a lot of attention in the media and within certain governments. Your company perceives there is a market advantage in removing chemical e.d. from your shampoos and claiming "endocrine disruptor free" on your shampoo bottles. To capitalize on this advantage, you must move quickly, before a competitor makes the same claim.

There are currently no direct regulations or clear "cause and effect" links regarding chemical e.d., so eliminating it from your shampoos would be a precautionary measure. Shampoo Maker GmbH management is aware of the issue and sees value in a precautionary approach, if it will bring an advantage in the marketplace.

# Role Four – Product Development Professional from Shampoo Maker GmbH

**Your aim**

Your aim is to provide technical product advice to help your colleague negotiate the terms of another contract with your supplier Chemical Supplier Inc. for a chemical you use to produce shampoos, called chemical e.d. You are working together with your colleague, a Procurement Professional, to negotiate the new contract.

**Your company, Shampoo Maker GmbH**

Your company Shampoo Maker GmbH makes shampoo, moisturizing lotions and other products for the personal care market.

You purchase a chemical called chemical e.d. from a company called Chemical Supplier Inc. It is a key ingredient in your shampoos. It comes in plastic drums, which you later rinse out with a simple detergent and have picked up by a recycler.

**Chemical e.d.**

Internal research and development has recently shown chemical e.d. may belong to a family of chemicals suspected to disrupt endocrine function in aquatic organisms and other animals when it enters the environment. Of all the ingredients you currently use, this is the only one that raises a potential flag with respect to endocrine function. While you currently need chemical e.d. for production, you know your company would soon like to phase-out the use of chemical e.d. in shampoos, because of its suspected impacts.

There are currently no direct regulations or clear "cause and effect" links regarding chemical e.d., so eliminating it from your shampoos would be a precautionary measure.

Shampoo Maker GmbH management has given verbal support to investigating alternatives to chemical e.d.

# Note pad & worksheet

Remember the key elements of eco-efficiency - options for eco-efficient products and services

- Re-engineer processes
- Revalorize by-products
- Redesign products
- Rethink markets

Use this space to note ideas, challenges and results of your negotiated contract

LEARNING UNIT C

# Implementing eco-efficiency

This part of the module aims to build the capacity of participants to implement eco-efficiency practices, moving eco-efficiency from a concept to reality. The emphasis is on using practical tools to assess, plan, and monitor. The first step is to understand what your company is currently doing, then take stock, assess the gaps, and plan for action.

# 1.0 Taking stock

## Background

Eco-efficiency covers a diverse range of issues including: rethinking markets, redesigning products, pollution or eco-innovation. Every company is at a different stage of the eco-efficiency journey for a variety of reasons: core business activities, the attitude of their top leadership, the industry sector and the key drivers for change. However, there are some common elements and themes faced by companies. Before you start implementing eco-efficiency practices within your company, it can be valuable to determine the current state of play. The detail you will go into in this activity is dependent on the type of company and participants.

## Purpose & learning objectives

These self-assessment questionnaires were developed to determine the current level of eco-efficiency activity in your company and to assist you in planning an eco-efficiency strategy that is tailored to your company's needs.

The tools can be used in a range of ways and at different levels of complexity, from a simple checklist to a more detailed evaluation:

- to introduce participants to the key components that need to be considered in developing an eco-efficient work in a business
- to assess what work is currently been undertaken within a business, or
- to identify gaps and activities for future application.

There are two versions of the activity. The first uses a short questionnaire designed to assess basic gaps and stimulate conversation at a management level. The second uses several detailed questionnaires and aims at a comprehensive understanding of activities in different areas within the company including:

- management
- product design and development
- purchasing
- accounting
- marketing and communications
- production and distribution, and
- facilities management.

## Materials

We provide handouts on the following pages for:

- the short questionnaire
- questionnaires for the seven company areas listed above
- an eco-efficiency profile to summarize results, and
- a round-up discussion of where your company is now, in terms of eco-efficiency strategy.

**Facilitating the activity: short questionnaire**

This activity should take about one-and-a-half hours. Hand out a copy of the questionnaire to each participant and ask them to work in pairs, reflecting on their company, function or team's current eco-efficient activities.

They should work through the 18 questions, responding yes or no, making comments on why they have responded that way, and giving examples. (For example, in question 6, what type of training in environmental management does your company provide? Is it sufficient, useful, regular, etc.?)

Bring the group back to plenary and invite group discussion about each of the questions. Capture ideas on a flipchart. Discussion points could include:

- Is your company doing enough towards eco-efficiency?
- What are the internal barriers to further development in this area?
- What are the external barriers and challenges?
- What would add strengths to the company?
- Who are the key eco-efficiency champions in the company?

Finally, group key points together and ask participants to consider what they do with this information. Encourage them to identify which challenges or gaps are within their sphere of influence and how they might take action. Other findings might be shared with key staff.

**Facilitating the activity: comprehensive questionnaires**

As above, hand out the questionnaire to participants and ask them to complete it. If you are short of time, give each participant one of the seven areas to review: management, product design and development, purchasing, accounting, marketing and communications, production and distribution, and facilities management.

Calculate the scores. Scores are calculated by dividing the number of "yes" responses by the number of questions, multiplied by 100 to give a percentage. If working in a group, it may be interesting to determine the average of the results in the group. This exercise will provide an estimate of the current eco-efficiency activity within your company.

Complete your eco-efficiency profile by transferring the self-assessment scores from the self-assessment worksheets to the eco-efficiency profile handout. You can now:

- calculate an average score for your organization, and
- sketch a bar chart showing the scores for each of the business functions and for the company average.

The graph bar chart will provide you with a useful visual representation of your profile to assist in communicating the results of your eco-efficiency self-assessment.

## Discussing your eco-efficiency strategy: where are you?

Review and discuss your eco-efficiency profile with participants. Compare your company's average score to the corresponding scores in the handout *Eco-efficiency: Where are you?* (page 161) to decide whether your company's eco-efficiency level is:

- coping
- informed, or
- proactive.

Participants should now try to answer the following key questions:

- What are the internal and external drivers?
- What priority areas should be focussed on for improvement?
- What specific actions should be taken?

These tools have been taken from *Productivity Through Eco-Efficiency, Three Steps to Eco-Efficiency* developed by Industry Canada. They have been reproduced with the permission of the Minister of Public Works and Government Services, 2003. There is a range of alternative tools available to help you through this process – see the Resources section of this module.

# Taking stock: short questionnaire

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 We have a written policy, supported by senior management, that links environmental performance with economic performance. | | | | |
| 2 Our company sets environmental performance and efficiency targets and measures progress toward them, for our products/business areas. | | | | |
| 3 We monitor the environmental innovations and productivity improvements of competitors and within our industry sector. | | | | |
| 4 Our company encourages (through rewards, bonuses, etc.) suggestions to improve resource, energy, and material efficiency. | | | | |
| 5 We track current and proposed environmental regulations and legislation that may impact our business (i.e. ourselves, our customers, our suppliers). | | | | |
| 6 Our company provides training in environmental management for our managers and staff. | | | | |
| 7 Our company has assigned a person(s) to be responsible for environmental and eco-efficiency matters. | | | | |
| 8 We have an environmental management system (e.g. ISO 14001) in place. | | | | |

# Taking stock: short questionnaire

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 9 We currently meet all environmental legislation and regulations that apply to our company's operations and products. | | | | |
| 10 We meet regularly with our stakeholders to inform them of our improvements in eco-efficiency and productivity. | | | | |
| 11 We have determined the main environmental impacts and costs of our products throughout their life-cycle (production, use and disposal). | | | | |
| 12 We work with other business functions to discuss and improve purchasing procedures, specification, criteria and efficiency. | | | | |
| 13 We require our suppliers to provide environmental information on their company and products. | | | | |
| 14 Our company measures the environmental costs associated with our activities. | | | | |
| 15 Our marketing and communications material includes environmental information. | | | | |
| 16 Our company provides information to customers on how to improve their environmental performance. | | | | |
| 17 We have taken measures to reduce material, water and energy use. | | | | |
| 18 Our company uses reusable/ recyclable materials. | | | | |

# Taking stock

## MANAGEMENT

Improving your financial performance and competitiveness through eco-efficiency requires leadership from management. Providing incentives and communicating a commitment to eco-efficiency is necessary to motivate employees, engage stakeholders, and to increase productivity and innovation.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 We have a written policy, supported by senior management, that links environmental performance with economic performance. | | | | |
| 2 Our company sets environmental performance and efficiency targets and measures progress toward them. | | | | |
| 3 We monitor the environmental innovations and productivity improvements of competitors and within our industry sector. | | | | |
| 4 Our company encourages (through rewards, promotions, etc.) suggestions to improve resource, energy, and material efficiency. | | | | |
| 5 We track current and proposed environmental regulations and legislation that may impact our business. (i.e. ourselves, our customers, our suppliers). | | | | |
| 6 Our company provides training in environmental management for our managers and staff. | | | | |
| 7 Our company has assigned a person(s) to be responsible for environmental and eco-efficiency matters. | | | | |

# Taking stock

## MANAGEMENT

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| **8** We have an environmental management system (e.g. ISO 14001) in place. | | | | |
| **9** We currently meet all environmental legislation and regulations that apply to our company's operations and products. | | | | |
| **10** We meet regularly with our stakeholders to inform them of our improvements in eco-efficiency and productivity. | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [10 – total N/A]

# Taking stock PRODUCT DESIGN AND DEVELOPMENT

Approximately 80% of a product's long-term environmental impacts and costs are established during the design stage. Product design and development are therefore very important considerations when seeking to provide innovative product improvements, decrease costs, and increase productivity and value to customers.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 We have integrated resource, material, energy and other efficiency criteria into the development of our products and capital projects | | | | |
| 2 Where possible, we use recycled, recyclable, renewable, or low-impact materials in our products and packaging. | | | | |
| 3 Our company attempts to minimize the amount of material used in product production, packaging, distribution and use to reduce waste and costs. | | | | |
| 4 Our designers and engineers use tools to improve the environmental performance and production efficiency of our products (life-cycle engineering, design for disassembly tools, etc.). | | | | |
| 5 Our products/services currently meet all applicable environmental regulations, safety and performance standards. | | | | |
| 6 Our product design and engineering criteria include increasing product durability and lifespan. | | | | |

# Taking stock PRODUCT DESIGN AND DEVELOPMENT

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| **7** We have made an effort to reduce or eliminate the toxic or hazardous substances used in the production and use of our products. | | | | |
| **8** We have designed and developed products that ease the disassembly, remanufacturing, recycling and disposal at the end of their useable life. | | | | |
| **9** We have determined the main environmental impacts and costs of our products throughout their life-cycle (production, use and disposal). | | | | |
| **10** Our company has established a program to increase the service intensity and/or leasing options of our products. | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [10 – total N/A]

# Taking stock

# PURCHASING

By optimizing the total cost of goods or supplies (including use and disposal costs), companies can increase operating and material management efficiency. A relationship between purchaser and supplier that encourages discussion of eco-efficiency will increase the likelihood of improved environmental performance, supply chain efficiency and innovation.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 We optimize the purchase of products/material that exhibit eco-logos or environmental labels, or contain recycled/renewable material. | | | | |
| 2 We base purchasing decisions on a total-cost or best-value approach (*ie* looking at the total cost of purchasing, use and waste management of a particular material, substance or product). | | | | |
| 3 We minimize or are phasing out the purchase, use, handling and disposal of materials and substances that are hazardous or toxic. | | | | |
| 4 We work with other business functions to discuss and improve purchasing procedures, specification, criteria and efficiency. | | | | |
| 5 We require our suppliers to provide environmental information on their company and products. | | | | |

# Taking stock

## PURCHASING

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 6 Our company provides education or assistance to suppliers on environmental matters in order to increase supply chain efficiency. | | | | |
| 7 We communicate our environmental purchasing criteria/requirements to marketing staff, employees, stakeholders, and customers. | | | | |

**TOTAL SCORE**

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [7 – total N/A]

# Taking stock

# ACCOUNTING

Identifying and tracking environmental costs can provide a stimulus for eco-efficiency improvements. Informing other business functions of these costs can lead to product, production and facility improvements, while encouraging innovation and increasing awareness.

Accounting systems can also be used to evaluate cost savings and/or revenue from environmental, efficiency and productivity improvements.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 Our company measures the environmental costs associated with our operations and processes (e.g. monitoring and abatement equipment, remediation, waste disposal, compliance costs). | | | | |
| 2 We measure the costs to our customers associated with the use and disposal of our products (e.g. energy and consumable use, recycling). | | | | |
| 3 The environmental costs to ourselves and our customers are communicated to personnel in all of our key business functions. | | | | |
| 4 We work with purchasing, facilities management and other functions to evaluate the environmental costs of capital purchases and new technologies. | | | | |

# Taking stock

# ACCOUNTING

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| **5** We work with management to allocate credits and performance bonuses to departments and business functions where efficiency and productivity improvements have been made. | | | | |
| **6** Environmental costs are allocated to the departments or business functions where they are generated (e.g. activity-based costing). | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [6 – total N/A]

# Taking stock MARKETING AND COMMUNICATIONS

An increasing number of consumers (individuals and institutions) are buying "green". Providing environmental information on your products and services can satisfy the information needs of this market segment and for other stakeholders (e.g. suppliers, insurers, investors and employees). Increasing awareness will help to brand your company as one that is committed to innovation, efficiency, and strong environmental performance.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 Our company monitors and responds to customer environmental concerns, requirements and/or activities. | | | | |
| 2 We utilize eco-logos or environmental labels on some/all of our products and services. | | | | |
| 3 Our company provides environmental information to new and existing employees. | | | | |
| 4 Our departments and business functions exchange information regarding environmental, performance and efficiency success stories. | | | | |
| 5 We have a marketing strategy that includes the environmental aspects of our products. | | | | |
| 6 Our product marketing and communications material includes environmental information. | | | | |

# Taking stock MARKETING AND COMMUNICATIONS

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 7 Our company provides environmental information to insurers, regulators, suppliers and financial institutions. | | | | |
| 8 Our company provides information to customers on how to improve their environmental performance. | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [8 – total N/A]

# Taking stock PRODUCTION AND DISTRIBUTION

Eco-efficiency is about doing more with less. This is achieved by optimizing the inputs (energy and material) and outputs (products and waste) of production and distribution processes. Investigating the efficiency of your inputs and outputs provides the stimulus for creating innovative solutions and productivity improvements.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 Our waste management operations include a recycling program for our production operations. | | | | |
| 2 We have taken measures to reduce material, water and energy use in production. | | | | |
| 3 Our production operation optimizes the use of energy generated from renewable sources or from waste. | | | | |
| 4 Our company uses reusable/recyclable shipping containers, pallets, skids or packaging. | | | | |
| 5 We use fleet management tools, techniques and technologies to optimize distribution and shipping efficiency. | | | | |
| 6 Our company has integrated environmental and efficiency criteria in process design. | | | | |

# Taking stock PRODUCTION AND DISTRIBUTION

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 7 We use by-products or wastes from one process in another product or process, or sell them to another company. | | | | |
| 8 We provide product refurbishing, remanufacturing, refilling or other services. | | | | |
| 9 Our company offers an exchange or take-back program to accept old or used products. | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [9 – total N/A]

# Taking stock

# FACILITIES MANAGEMENT

Optimizing energy and material flows in the operation and maintenance of facilities can lead to lower overhead costs. In addition, high-efficiency plant layouts, heating and ventilation, and manufacturing systems, can provide productivity gains from improved employee health and well-being.

Please respond Yes, No or Not Applicable (N/A) to each of the following statements. Your response should reflect the current conditions within the company.

| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| 1 We have a waste management program in place that minimizes handling costs and complies with all applicable regulations. | | | | |
| 2 We select and use energy-efficient electrical, mechanical and lighting fixtures. | | | | |
| 3 Our company has developed a prevention program to identify and eliminate sources of pollution and reduce costs. | | | | |
| 4 We have taken measures to improve the indoor environmental quality of our facilities (e.g. day-lighting and air quality). | | | | |
| 5 We have water conservation measures in place to reduce costs and increase efficiency. | | | | |
| 6 We work with other business functions and property managers to seek facility improvements and optimize maintenance. | | | | |
| 7 We have a grounds management plan that suits the natural landscape and local eco-system, and reduces maintenance costs. | | | | |

# Taking stock

# FACILITIES MANAGEMENT

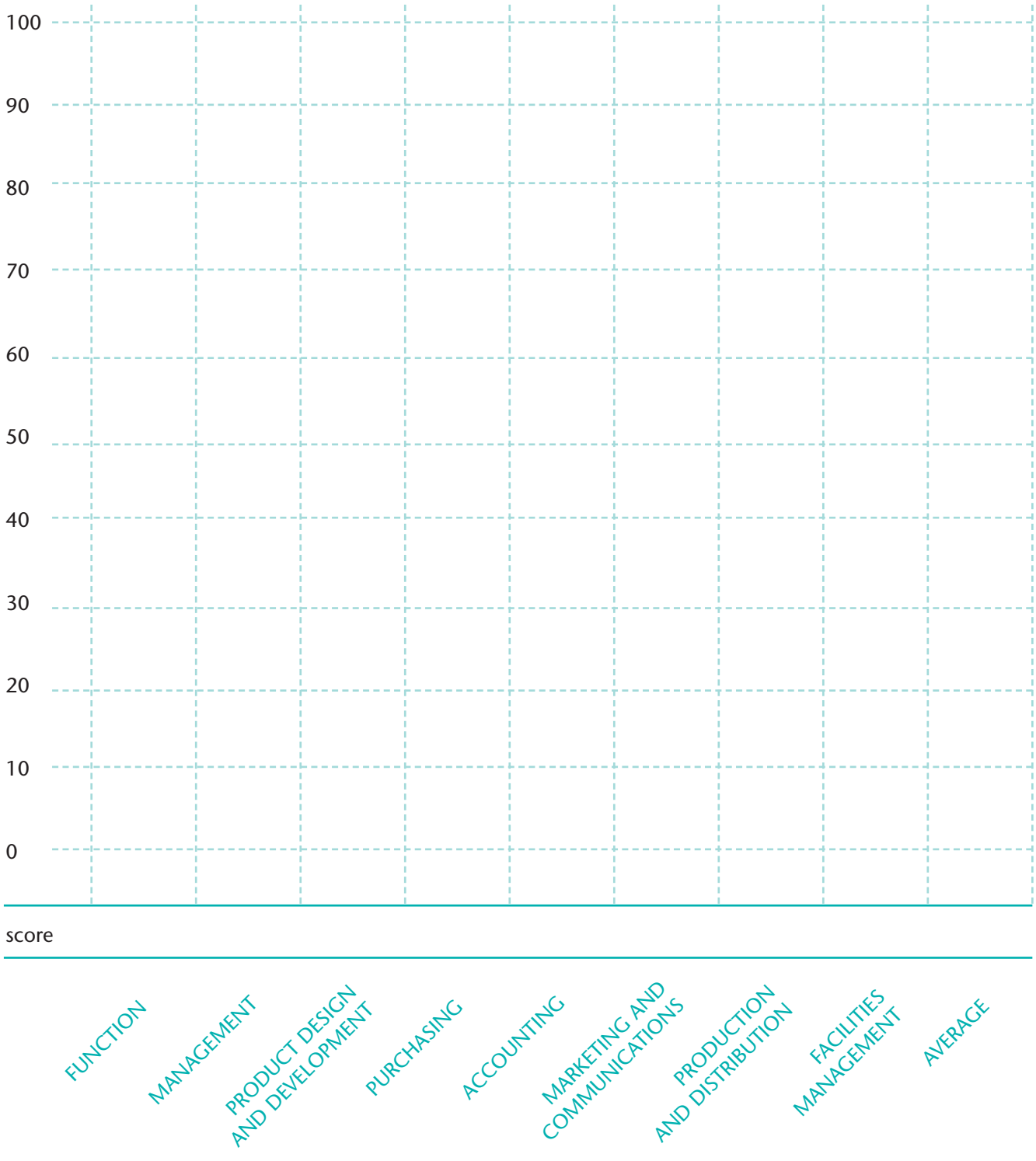
| QUESTION | EVIDENCE/SUGGESTION | YES | NO | N/A |
|---|---|---|---|---|
| **8** Our company has a program to promote and track the reduction of waste. | | | | |
| **9** Our construction contractors follow site management guidelines to reduce waste, recycle or remanufacture materials and minimize pollution. | | | | |
| **10** We have integrated environmental criteria in the design of new production facilities (e.g. energy efficiency, material and resource conservation). | | | | |

## TOTAL SCORE

**Calculate your score**

_____ divided by _____ = _____ multiplied by 100 = _____%
[total Yes] [10 – total N/A]

# Your eco-efficiency profile



# Eco-efficiency: Where are you?

Use the average score calculated from your eco-efficiency profile to determine which of these three columns best represents your company's present position.

## 0–33% COPING

**Possible internal drivers:**

- Cost reduction
- Health and safety of employees
- Productivity concerns.

**Possible external drivers:**

- Reducing liability
- Regulations or legislation
- Financial performance.

**Pros:**

- Focused on optimizing costs and in complying with environmental regulations (in areas such as reporting, permitting and auditing)
- Reacting and changing quickly to crises concerning the bottom line
- Incorporating compliance costs into strategic business plans
- Exploiting obvious opportunities for productivity improvements.

**Cons:**

- Vulnerable to changes in legislation, customer requirements, market trends or competitor tactics
- Minimal engagement with stakeholders, external organizations and suppliers
- Changes are motivated by the desire to manage risks and reduce costs
- Limited environmental functions or personnel
- Informal management systems, procedures and internal communication of productivity and innovative improvements.

## 34–66% INFORMED

**Possible internal drivers:**

- Product quality
- Material and energy efficiency
- Standards.

**Possible external drivers:**

- Activities of industry and trade organizations
- Customer demands
- Product, corporate and brand image.

## 34–66% INFORMED

**Pros:**

- Tracking and planning for regulatory, legislative and standardization trends
- Active participation in industry and trade associations
- Quick to react to demands from customers, actions of competitors and other trends
- Implementation of programs for the efficient use of materials and/or energy
- Actively improving products, processes and operations to meet evolving customer needs

**Cons:**

- Limited integration of environmental management and other business programs
- Limited engagement with suppliers and stakeholders
- Limited activities to train, motivate and support employees

## 67–100% PROACTIVE

**Possible internal drivers:**

- Employee morale and relations
- Stimulating innovation
- Long-term profitability

**Possible external drivers:**

- Supplier activities or demands
- Gaining competitive advantage
- Establishing new markets
- Long-term access to capital and financing
- Changing social attitudes

**Pros:**

- Eco-efficiency provides means to stimulate innovation and realize competitive advantage and enter or maintain presence in certain marketplaces
- Active engagement with stakeholders, insurers, investors, suppliers and customers to seek productivity and environmental improvements
- Actively involved in employee training, by providing incentives and ongoing development
- Full integration of environmental considerations into management systems, product development and other business functions
- Actively exploring service and product alternatives
- Aggressive implementation of cost-saving opportunities through resource and energy-efficiency improvements

**Cons:**

- Extensive internal and external efforts and resources needed to maintain leadership position

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 2.0 Applying the eco-efficiency tool box

"What makes these… companies stand out is their ability to manage strategic profit opportunities, that is, their ability to profit from recognizing new environmental and social markets."

INNOVEST ranking of the world's most sustainable corporations, January 2005

## Background

Organizations can use a range of concepts and tools to support the integration of eco-efficiency into their decision-making processes. A recent multi-stakeholder study on concepts and tools, which involved five WBCSD members (Suncor, Dow, P&G, Interface and Alcan) and was led by Pollution Probe (a Canadian non-governmental organization), noted the following about the tool box available to industry to improve eco-efficiency[1]:

- The "tool box" can be characterized a number of ways, for example by the main types of tools: organizational or management-focused tools (e.g. environmental management systems and environmental supply chain management), product-focused tools (e.g. eco-innovation, life-cycle assessment, green procurement), operational and risk management tools (e.g. pollution prevention), and communication and marketing tools (e.g. reporting, eco-labeling).
- Some tools can be applied at different levels within the organization (e.g. product versus business unit) and companies need to select tools appropriate for their situation, as not all tools apply to all companies.
- Many of the tools are widely known and used by industry (e.g. environmental management systems and pollution prevention), while others are gaining in significance (e.g. design for the environment or eco-design).
- Some tools are used primarily by industry (e.g. design for environment/eco-design), some used primarily by government (e.g. extended producer responsibility), and some tools used by both (e.g. green procurement).

To understand how to properly apply the tools, decision makers need information on the scale at which the tool is applied (e.g. product, operations, business unit and corporate), the benefits and costs associated with using the tool, and the time required for implementation or achieving business benefits. In addition, a life-cycle dimension may also be helpful. This could include where in the life-cycle of a product or in a project the tool would apply.

[1] The study used the term environmental sustainability as a frame of reference. See www.pollutionprobe.org

Carefully evaluating and selecting from the available tools will help organizations ensure resources are not wasted, the appropriate information is gathered to inform decisions, and the tool fits with organizational culture (e.g. a company with a science and engineering culture usually requires more quantitative/ analytical tools).

This exercise builds on the range of tools and concepts already introduced in the "Understanding" and "Exploring Eco-efficiency" sections (e.g. supply chain management, life-cycle assessment) and helps participants think through the application of eco-efficiency using practical examples from WBCSD companies. The objective is to illustrate the range of available tools and to familiarise participants with their application.

## Purpose & learning objectives

The purpose of this exercise is to 1) give an overview of the existing and emerging tool box to support eco-efficiency implementation, 2) describe a range of these tools in more detail, and 3) have participants take part in an interactive exercise/discussion illustrating the application of the tools in different business decision-making contexts.

## Materials

- Slide presentation on the eco-efficiency "tool box". A slide presentation introduces some general characteristics of the emerging tool box and some of the key tools being used to support eco-efficiency.
- Slides and scorecard for conducting the exercise "applying the eco-efficiency tool box". The exercise consists of 14 animated PowerPoint slides (with embedded notes) that describe a specific scenario or company application of a tool. Also give each participant team a copy of the "scorecard" to keep track of each team's ability to match the scenario with the appropriate tools/concepts. The objective of the exercise is to have participants match eco-efficiency concepts and tools to specific scenarios, project outcomes or decision-making contexts.

## Facilitating the activity

The activity should take approximately one hour (assumes a maximum of 20 participants).

Tip: The activity is ideal for a group of participants with mixed disciplines and a range of experiences.

The facilitator gives the overview presentation on the leading eco-efficiency concepts and tools along with definitions (30 minutes).

After the presentation, participants are divided into groups of four or five. Each group is provided with a score sheet. The facilitator then presents specific scenarios, decision-making contexts or company examples. Each team must then determine which tool(s) or answer is appropriate for the scenario/situation presented. Teams record their answers on the score sheet provided. The facilitator then presents the next scenario, etc. Depending on the time available, 8–10 scenarios/situations can be presented. The facilitator presents the right answers (on a PowerPoint slide) after each scenario. For a light competition, each team can count up their score at the end and a winner be declared. The exercise reinforces participant understanding of the scope of the tool box and possible applications of the tools. As each right answer is presented, the facilitator should encourage teams to ask questions and discuss their answers (i.e. why a particular tool does not apply to a scenario, benefits and outcomes of using the tool in that scenario, etc., other possible answers, as the groups' interest permits).

If the participants are new to eco-efficiency, it might be helpful to print out descriptions of the tools to refer to during the exercise.

**Other notes**

It is important to communicate that in some case, more than one tool/concept might apply.

If a participant has used a particular concept/tool, encourage them to describe the application of that tool.

The primary value of the exercise is that participants discuss, and think through the application of the tools (i.e. what types of decisions require which tools).

**Take-away message**

Participants should become familiar with existing tools, emerging tools and what those tools can accomplish. They should learn a few of the tools in further detail and go away with the ability to recognize how a particular tool may be applied (or adapted) within different business decisions.

# Slides for facilitator – introducing the eco-efficiency tool box

DEDICATED TO MAKING A DIFFERENCE

## Eco-efficiency tool box

Learning unit C: implementing eco-efficiency

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## Learning objectives

- Become familiar with existing tools and emerging tools and what they do
- Learn a few of the tools in further detail
- Recognize how a particular tool may be applied (or adapted) within different business decisions

## Structure

- Overview
- Description of common tools
- Quiz
- Responses
- Discussion

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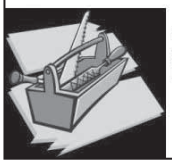
## Tools for eco-efficiency

- Sustainability mindset has led to an explosion of concepts and tools
- Academics, NGO's, consultants, industrial researchers all working on solutions
- Result is a proliferation of tools with some overlap
- This can create confusion in the marketplace of ideas – but this is understandable – living in a beta/VHS/DVD/digital world – the winning approach is evolving



Labeling concepts and tools may be an impediment – the key is to understand the problem you are trying to solve and select the appropriate tool for the job and/or modify tools as needed

## Typical tools for implementing eco-efficiency

- Organizational/Management
  - Environmental Management Systems
  - Stakeholder Engagement
  - Corporate Environmental Reporting
  - Life-Cycle Management
- Product Design & Development
  - Design for Environment
  - Eco-Efficiency Analysis
  - Life-Cycle Assessment
  - Environmental Risk Assessment
  - Integrated Product Policy (IPP)
- Suppliers/Purchasing
  - Environmental Supply Chain Management
  - Green Procurement
- Marketing and Communications
  - Corporate Environmental Reporting
  - Eco-Labelling
  - Stakeholder Engagement
- Production & Distribution
  - Eco-Efficiency Analysis
  - Industrial Ecology
  - Pollution Prevention
  - Life-Cycle Costing
- Facilities Management/Project Development
  - Green Building Design
  - Environmental Impact Assessment
  - Environmental Management Systems
  - Stakeholder Engagement

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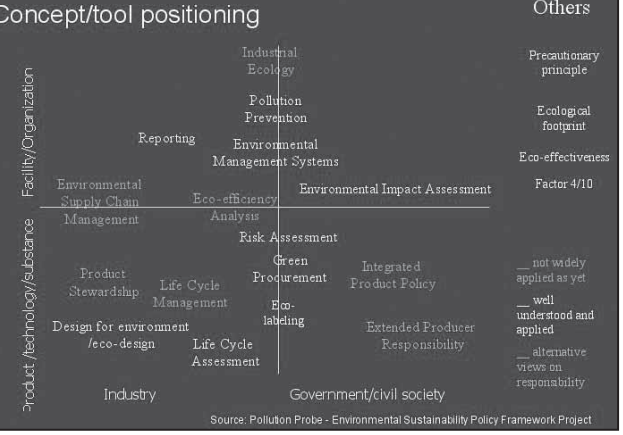
- Note - Some tools cross over (e.g., eco-efficiency analysis and stakeholder engagement could apply across all functions)

## Concept/tool positioning




Source: Pollution Probe - Environmental Sustainability Policy Framework Project

## Observations on the tool box

- **Adoption of tools being driven by:**
  - Market factors (e.g. EMS in automotive, labelling)
  - Stakeholder expectations (e.g. reporting, stakeholder engagement)
  - Regulatory influences (e.g. pollution prevention, ERA, EIA)
  - Internal business factors including efficiency, cost reduction, innovation (e.g. DfE, LCA, Green Building Design)
  - Combination of the above (e.g. procurement, eco-efficiency)
- **Tool box varies for different parts of value chain**
- **Culture, drivers, strategy, awareness all factors in adoption and depth of integration in organizations**
- **Tools apply at different levels (corporate, operational, product) and selection is specific to the organization**
- **Many tools have inherent value judgments and users need to be aware of this (e.g. eco-labels can reflect values of those who develop the selection criteria)**

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## Business case

- **Innovation – the application of a number of tools (DfE, LCA, Eco-efficiency Analysis) fosters development of new or alternative project, product or technology designs**
- **Improved stakeholder relations through better communication internally and externally around environmental issues, performance, projects and management practices**
- **Strengthened brand image and reputation as seen by regulators, the public, peers, employees and other stakeholders who recognize the value of the company's environmental efforts**
- **In many cases there is a clear and measurable reduction in operating costs**
- **Many companies attribute increased sales to the use of these concepts and tools**
- **Indirect savings are realized through the avoidance of environmental risk**

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## Eco-efficiency tool box

Descriptions of common tools

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## Life-Cycle Assessment (LCA)

- A decision-making tool to identify environmental burdens and evaluate the environmental consequences of a product, process or service over its life-cycle from cradle to grave
  - **standardized by the International Organization for Standardization**
  - **forms the conceptual basis for a number of management approaches that consider a product across its life-cycle, covering resource acquisition, product manufacturing, product use, and end-of-life**

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## LCA – key elements

- **Consideration of multiple life cycle stages**
  - the physical sequence of operations in a product system, cradle-to-cradle or earth-to-earth
  - the primary stages are materials acquisition and processing, manufacturing, use and end-of-life disposal
  - within each of these stages, sub stages or unit processes are defined
- **Consideration of multiple environment and resource issues**
  - LCA studies expose trade-offs by analyzing significant inputs from the earth and outputs to the environment across the various life-cycle states
- **An assessment or interpretation of the significance of the results**
  - can vary from aggregation of data into a set of simple indicators to the consolidation of the data into a core set of indicators using a variety of weighting or scoring methods

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## When to apply LCA

LCA can help decision-makers to:

- Identify unintentional impacts of actions (e.g. upstream GHG emissions that may offset perceived benefits of a new technology)
- Ensure consideration of all environmental media across the life-cycle (e.g. equal consideration of emissions to air, water and land during project construction, operation and decommissioning)
- Avoid shifting problems from one life-cycle stage to another, from one geographic area to another and from one environmental medium to another (e.g. ensuring an air pollution mitigation measure does not create a water pollution problem elsewhere in the system)
- Identify opportunities to improve the environmental and economic performance of the technology, project, product or service in question (e.g. identifying "hotspots" that need to be addressed)
- Communicate more effectively with stakeholders on the system wide consequences of project or technology options (e.g. to communicate full impacts and/or benefits of changes to a product system)

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## Design for Environment (DfE) or Eco-design

- The integration of environmental considerations into product and process design
  - Fundamental to DfE is the use of tools and practices that encourage environmental responsibility and simultaneously reduce costs, promote competitiveness and enhance innovation
  - DfE practices are meant to develop more environmentally compatible products and processes while maintaining (and in some cases even exceeding) price, performance and quality standards

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## DfE - key elements

- Selection of low-impact materials
- Reduction of energy use
- Optimization of production techniques
- Optimization of distribution system
- Reduction of use phase impacts
- Optimization of initial lifetime
- Optimization of end-of-life system

- In addition, designers are encouraged to produce products which lead to less material use (e.g. dematerialization), to pursue shared product use (e.g. car clubs or rental services), to integrate product functions (e.g. combined scanner, printer, copier, fax), and to optimize functions (e.g. better design to reduce over packaging)

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## When to apply DfE/eco-design

- At the front end of the product development process (e.g. at the planning and conceptual design phase)
- Often the design strategies are informed by prior analytical work on the life cycle cost and environmental impacts of the previous generation of products
- In innovation processes DfE may be used to inform product design (e.g. material selection) through the use of design checklists

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## Environmental labelling

- A broad range of activities ranging from business to business transfer of product specific environmental information to environmental labelling in retail marketing
- The overall goal of eco-labelling is to encourage the demand for, and supply of, products and services that are environmentally preferable through the provision of verifiable, accurate and non-deceptive information on environmental aspects of products and services

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## Types of labelling

- "Seal of approval" eco-labelling programs through product category definition, development of award criteria and product evaluation
- Self-declaration eco-labels are based on a manufacturer's self-declared claim about a product's environmental performance
- Product declarations are informational labels that provide environmental data and information on a variety of measures or indicators

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## When to apply eco-labelling

- When communicating the environmental performance of the product or service is of value to customers or other important stakeholders
- The choice of which type of label to use should be informed by an understanding of your customer/stakeholder information needs
- Receiving or creating the label may involve a considerable amount of data collection

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## Cleaner production/pollution prevention

- The continuous application of an integrated preventive environmental strategy applied to processes, products and services to increase eco-efficiency and reduce risk for humans and the environment
  - For processes, cleaner production includes conserving raw materials and energy, eliminating toxic raw materials and reducing the quantity and toxicity of all emissions and wastes before they leave a process
  - For products, the strategy focuses on reducing impacts along the entire life-cycle of the product, from raw material extraction to the ultimate disposal of the product

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Source: *Cleaner Production*, UNEP Industry and Environment, UNEP 1994

## Cleaner production – key elements

- Cleaner production is a broad term encompassing the following concepts:
  - Waste minimization and avoidance
  - Pollution should be prevented or reduced at the source whenever feasible
  - Environmental management
  - Substitutions for toxic and hazardous materials
  - Process and product modifications
  - Internal reuse of waste products

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## When to apply cleaner production

- When the company has set a strategic direction to improve the overall eco-efficiency performance of its products and processes
- Adopting a cleaner production approach involves considerable adjustment to decision-making across a range of business processes and functions

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## Green procurement

- The procurement of goods and services that have less impact on the environment (e.g. conserve energy, reduce waste, etc.) than other products or services meeting similar performance requirements

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## Green procurement – key elements

- Incorporate environmental considerations as part of the normal purchasing process
- Incorporate pollution prevention principles early in purchasing process
- Examine total multiple environmental impact throughout the product and service's life-cycle
- Environmental impacts should be compared when selecting products and services
- Comprehensive, accurate and meaningful information about the environmental performance of products and services should be collected in order to facilitate environmentally sound decision-making

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## When to apply green procurement

- When there is a clear opportunity to reduce risks, integrate broader cost considerations or leverage environmental performance through procurement
- Pursuing green procurement may involve adjusting tendering processes, altering contract language, training procurement officers and developing evaluation criteria and tools

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## Environmental supply chain management

- A range of detailed environmental requirements companies (in particular manufacturers) are placing on their suppliers, including Environmental Management Systems and Design-for-Environment programs, restricted material lists, component take-back commitments, requests for life-cycle data and performance disclosures

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## ESCM – key elements

- Environmental supply chain programs are aimed at achieving:
  - Improved efficiency of energy
  - Appropriate materials – ensuring the supplier uses environmentally appropriate materials
  - Clean production – ensuring the supplier has safe and clean production practices in place
  - Optimize distribution and logistics to reduce environmental impact and cost
  - Responsible use – ensuring the "buyer" understands how to use the product or material responsibly
  - End-of-life stewardship – where the supplier takes back their product at the end of its useful life

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## When to apply ESCM

- ESCM is most important when the suppliers' product or service is an integral component of your product or service (e.g. automotive supplier that provides entire subsystems of an automobile or contract manufacturers in the apparel industry)
- Implementing ESCM may involve the development of evaluation and auditing procedures for existing suppliers as well as screening criteria for potential new suppliers
- Many companies form partnerships with key suppliers to improve eco-efficiency performance as it is in both their interests

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## Environmental Management System (EMS)

- The organizational structure, responsibilities, practices, procedures, processes and resources for implementing and managing an organization's environmental affairs while ensuring conformity to its policies, standards and stakeholders' expectations

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## EMS – key elements

- The foundation of an EMS includes:
  - Purpose – an organization should have an identifiable purpose, which is usually stated as its goals and objectives and encapsulated in the organization's environmental policy
  - Commitment – there should be a sense of commitment and accountability among the people in the organization with respect to taking the appropriate action in support of the EMS
  - Capability – the organization should have the necessary resources (human, physical and financial) as well as the knowledge and skills to achieve the organization's environmental policy
  - Learning – the organization should strive to continuously learn to improve its own management and learning processes through monitoring and measurement of environmental performance, efficient internal and external communication as well as review of the EMS by senior management

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## When to apply EMS

- When the systematic management of environmental issues is 1) of importance to customers, 2) critical to your business success, or 3) required to ensure common awareness and performance across your organization
- While there has been an increased awareness of EMS due to the creation of the international standard on EMS (ISO 14001) it is important to understand there are a variety of EMS's in use by industry such as Responsible Care in the chemical industry, the EU standard EMAS (Eco-audit and Management Scheme) and others
- Typically implementing an EMS requires: management commitment, active engagement and training at all levels of the organization, open communication with regulatory agencies, in-depth aspects and impacts assessment and energetic EMS champions

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## Life-Cycle Management (LCM)

"A flexible integrated framework of concepts, techniques and procedures to address environmental, economic, technological and social aspects of products and organizations to achieve continuous environmental improvement from a life-cycle perspective"

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Source: *Life Cycle Management: Definitions, Case Studies and Corporate Applications*. Society of Environmental Toxicology and Chemistry (SETAC), Working Group on Life Cycle Management.

## LCM – key elements

- Understanding full product system
- See outside traditional boundaries
  - Beyond gates, after sales
  - Beyond compliance
- Determine drivers
- Take responsibility
- Manage it as a business initiative – integrate into business decision-making processes

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## When to apply LCM

- When you want to better understand the business risks and opportunities of upstream and downstream aspects of your activities and are ready to integrate consideration of these risks and opportunities into core business processes and functions
- Integrating life-cycle management considerations can involve applying a range of tools (e.g. LCA, DfE) but more importantly involves ensuring the organizational decision-making processes and measurement systems reflect and integrate life-cycle considerations (e.g. managers are responsible and accountable for ensuring life-cycle aspects of decisions are considered and acted on)

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# Tool kit game illustrations

**Eco-efficiency tool box**

Quiz

## Question/Scenario1

- This is an approach to eliminating substances of concern from facilities that can save money and improve environmental, health and safety performance
- Dow Chemical has used this tool/approach to voluntarily reduce emissions and avoid burdensome administrative conditions. In one region they were able to reduce the release of ethylene dichloride (EDC) and save approximately $2 million per annum

This was achieved through a voluntary **pollution prevention** effort that promoted better relationships with environment regulators and reduced regulatory demand.

## Question/Scenario 2

The automotive industry is one of the most sophisticated users of this tool. The table below shows data generated by the tool which enables the comparisons of different material options for a car fender. Name this tool.

LCA

| | Al | St | PC/PBT | PP/ EPDM | PPO/PA |
|---|---|---|---|---|---|
| energy | 1290 | *1120* | 1060 | 810 | 1080 |
| resources | 15 | 25 | 18 | *14* | 21 |
| water | 36 | 27 | 22 | 17 | 25 |
| GWP | 104 | 105 | 83 | 62 | 115 |
| ODP | 1 | 0,1 | 0,4 | 0,2 | 1,2 |
| AP | 28 | 19 | 20 | *16* | 20 |
| EP | 4,4 | 4,2 | 3,9 | *3,5* | 7,2 |
| POCP | 6,7 | 9,2 | 8,7 | 8 | 9,1 |
| Htox air | 3,8 | 3,7 | 2,5 | *1,9* | 2,5 |
| Htox water | 0,66 | 0,92 | 0,99 | 0,62 | 0,74 |
| Eco tox | 2,9 | 3,4 | 2,7 | 1,9 | 2,4 |
| waste | 3,7 | 1,2 | 1 | 0,25 | 0,25 |

## Question/Scenario 3

3M's product development team uses this tool to systematically address and evaluate the environmental, health and safety opportunities and issues. It does not require a lot of data but rather it draws upon the knowledge of a cross-functional team that understands the product, the processes used to make it, the materials in it and what happens to the product after it leaves the factory gate. What is it?

**Life Cycle Management Process**

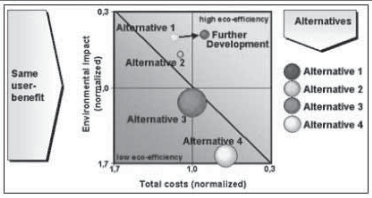
| Life Cycle Stage / Impact | Material Acquisition | R&D Operations | Manufacturing Operations | Customer Needs: Use | Customer Needs: Disposal |
|---|---|---|---|---|---|
| Environment | | | | | |
| Energy / Resources | | | | | |
| Health | | | | | |
| Safety | | | | | |

## Question/Scenario 4

Name this strategic and marketing tool developed by BASF that provides a quantitative measure of the economic and ecological benefits of a product or process as compared to other products or processes

Eco-efficiency Analysis - The "Portfolio"

The "Eco-efficiency Portfolio" combines environmental and economic considerations




## Question/Scenario 5

In a manufacturing company, like United Technology Corporation, which function within the organization is best positioned to apply eco-efficiency tools and concepts?

- EPA Fine
- Hazardous waste
- Compliance driven
- EHS adds cost

*EH&S Owns Problem*

- Haz waste reduced 85%
- Air releases down 90%
- Injury rate down 90%
- EHS saves $

*Manufacturing Owns Solutions*

- LCx, DfE
- Env. preferred materials
- Clean mfg.
- New business
- EHS adds strategic value

*Engineered Solutions Become Success*

Source: UTC's PROGRAM EVOLUTION T. Swarr, UTC

## Question/Scenario 6

Provide three reasons why the environmental and social performance of suppliers is an important but increasingly complex issue for multi-national companies.

- Globalization, outsourcing and new types of business joint ventures, and business integration are beginning to blur the boundary lines between suppliers and producers
- Responsibility for the performance of suppliers is perceived by NGOs and large part of the society to rest with the company that designs and markets the end product
- Environmental and social issues with the potential to seriously affect company reputation, often arise somewhere in the supply chain

- Many things are (perceived as) outside your control and not within your responsibility
- Your supplier base might seem overwhelmingly large in numbers
- Many approaches for managing environmental and social risks along the supply chain imply big human and financial resource demands
- It immediately adds costs and sometimes the benefits are hard to quantify and will only be accrued in the distant future

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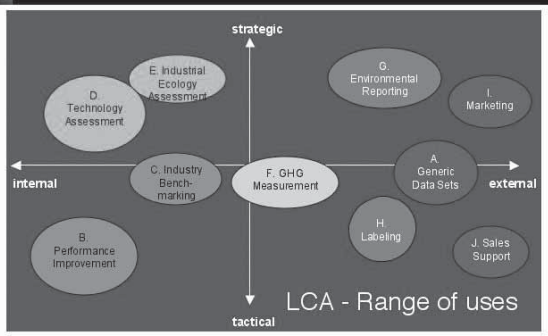
Source: Paths to Sustainability in Supply Chain Management: Nordic Partnership SCCM Diagnostic Tool August 2004

## Question/Scenario 7

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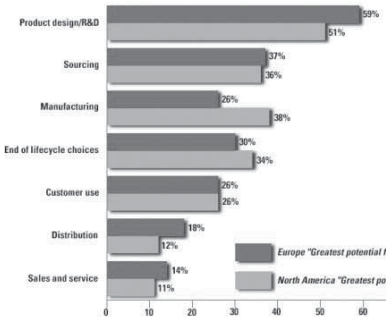
## Question/Scenario 8

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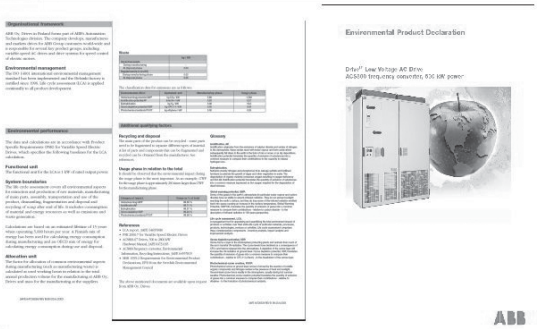
Source: Arthur D. Little (2000)

## Question/Scenario 9 What type of eco-label is ABB using here?

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## Question/Scenario 10

- What tool did the re-insurance company Swiss RE say (in 1998) had enough of a solid conceptual basis that it could benefit insurers by:
  - Providing information that enabled insurers to underwrite environmental risks based on analytically reliable trends in data which
    - reflected the insured companies environmental performance over time
    - reduced uncertainty about policyholder exposure
    - and lead to a position of enhanced loss prevention.
  - Further they noted that the insured company's use of this tool was a potential benefit because it:
    - could reduce risks and help improve relationships with insurers and other stakeholders
    - supported achieving mores eco-efficient products and process and the company's contribution to sustainable development.

Environmental Management Systems

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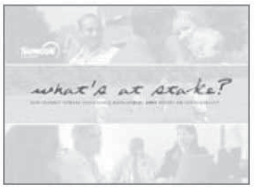
Source: Swiss Re America. Environmental Management Systems and Standards

## Question/Scenario 11

- What tool provides the energy company Suncor with a regular opportunity to engage in a conversation on environmental performance and sustainability within the company?




Their sustainability report

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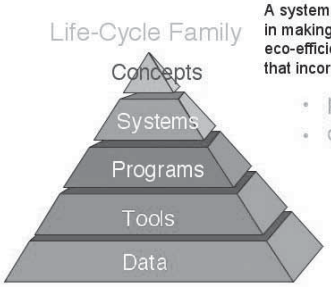
## Question/Scenario 12




A systems or life-cycle perspective is critical in making the right choices for improving eco-efficiency. Name two tools (other LCA) that incorporate a systems perspective.

- product stewardship
- design-for-environment (DFE

Eco-efficiency analysis
Life-cycle assessment
Life-cycle inventory (LCI)
Life-cycle costing/total cost of ownership

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## Question/Scenario 13

**Stretch Targets**

- In implementing eco-efficiency Unilever uses these to drive improvement – what are they?

Eco-efficiency in Manufacturing

| Target | Performance | Target reduction 2003 % | Actual reduction 2003 % |
|---|---|---|---|
| COD | Target met | 7.7 | 9.1 |
| Hazardous waste | Not met | 28.6 | 0.4 |
| Non-hazardous waste | Not met | 8.5 | 2.3 |
| Water | Target met | 5.9 | 13.0 |
| Energy | Target met | 2.9 | 4.1 |
| CO2 from energy | Not met | 2.5 | 1.9 |
| Boiler / Utilities SOx | Target met | 7.9 | 17.2 |

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Source www.unilever.com

## Question/Scenario 14

What concept has consumer products company Henkel leveraged to drive eco-efficiency considerations into all of its products and to even go beyond selling of the product?

**Product Stewardship**

- Henkel continuously improves the safety and environmental compatibility of its products in all phases of their life-cycle, including design, development, production, transport, use and disposal. These aspects are taken into account from the outset in product There are three components of their approach to Product Stewardship
  - Life-cycle – understand the life-cycle and optimize performance
  - Systematic approach – give due consideration to the key specific aspects of safety, health, environment as well as customer requirements
  - Systems businesses – offers innovative solutions that go far beyond the "simple" sale of products

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Source: http://www.henkel.com/

# Handout for participants – game scorecard

| QUESTION/SCENARIO (1 point per correct answer) | APPROPRIATE TOOL/ANSWER | SCORE |
|---|---|---|
| 1 Dow Chemical | | |
| 2 Data Intensive tool used to compare material types for an automotive application. | | |
| 3 Screening tool used by 3M to evaluate environment, health and safety risks and opportunities at the front end of the product development process. | | |
| 4 Strategic and marketing tool used by BASF to evaluate economic and environmental aspects of new technologies and products. | | |
| 5 In a manufacturing company such as Untied Technologies Corporation, which function within the organization is best positioned to apply eco-efficiency tools and concepts? | | |
| 6 Provide three reasons why the environmental and social performance of suppliers is important. | | |
| 7 Name three applications of a life-cycle assessment study. | | |

| QUESTION/SCENARIO (1 point per correct answer) | APPROPRIATE TOOL/ANSWER | SCORE |
|---|---|---|
| **8** Where is the greatest opportunity to improve eco-efficiency performance? | | |
| **9** What type of eco-label is ABB using here? | | |
| **10** What tool did the re-insurance company Swiss RE say could benefit insurers? | | |
| **11** What tool provides the energy company Suncor with a regular opportunity to engage in a conversation on environmental performance and sustainability within the company? | | |
| **12** Name two tools (other than LCA) that incorporate a systems perspective. | | |
| **13** In implementing eco-efficiency, Unilever uses these to drive improvement – what are they? | | |
| **14** What concept has consumer products company Henkel leveraged to drive eco-efficiency considerations into all of its products and go beyond selling of the product? | | |
| | **Total** | |

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 3.0 Revalorizing by-products

**Background**

Understanding the elements of eco-efficiency can help companies to identify where opportunities can be found, and who – inside and outside the company – will be involved in exploiting them. The WBCSD has defined four key elements of eco-efficiency:

- re-engineer processes
- revalorize by-products
- redesign products, and
- rethink markets.

(For more details, please refer to section 1 of Learning unit B in this module.)

This activity is based on a short video exploring the concept that by cooperating with other companies, many businesses have found creative ways to revalorize their by-products. In striving for zero-waste or 100%-product targets, they have found that the so-called waste from their processes can have value for another company. Sometimes, in the chemical industry for example, by-products have even become a real cash-generating product of a production process.

Zero-waste targets and by-product synergies lead to the more effective use of the resources in a process and create an additional cash benefit. In short, they are eco-efficient because they allow creation of more value with fewer resources.

The video was produced by the US BCSD (formerly Gulf of Mexico BCSD), who has published a brochure with case studies on the topic.

**Purpose & learning objective**

To explore in more depth the concept of revalorizing by-products – the by-product synergy/industrial ecology principle, one of the four key elements to implementing eco-efficiency.

**Materials**

Video.

**Facilitating the activity**

Provide background on the concept of revalorizing by-products (see section 1 of Learning unit B in this module).

Play the video, which takes about nine minutes.

Discuss questions arising from the video. For example:

- What are the main barriers to implementing this concept?
- How can the barriers be overcome?
- How can diverse industries be persuaded or encouraged to interact to find the opportunities? (This is one of the biggest barriers.)

# 4.0 Measuring eco-efficiency

## Background

Companies measure their eco-efficiency performance to track and document progress, identify and prioritize opportunities for improvement, and identify cost savings and other benefits related to eco-efficiency. Indicators provide measurable entities, which can then help managers to make decisions on a product or business portfolio. They can provide managers with the information on how to make a business portfolio more eco-efficient or more sustainable overall – and usually more profitable as well.

Monitoring and reporting eco-efficiency publicly is a way to communicate a key element of the corporation's progress on sustainable development to external audiences, including investors, insurers, consumers, and other interest groups. Defined indicators provide systematic and verifiable ways to report. See *Background briefing on eco-efficiency* (page 27) for the WBCSD's work in this area.

## The Eco-Compass measurement tool

The Eco-Compass tool[1], developed by Fundación Entorno of Spain, is one tool that can be used by companies to graphically represent improvements made in process and product design. They define six key indicators:

1 Intensity of raw material use (including water)
2 Intensity of energy consumption
3 Generation of liquid, solid and air emissions
4 Efficiency in transportation of the product
5 Content of toxic substances in the product
6 Durability and functionality of the product or service.

The first three indicators refer to the environmental impacts of the fabrication of the product or service, while the latter three refer to the product or service distribution and use.

The two diagrams on the opposite page show the "base case"[2] – the situation prior to implementing eco-efficiency practices, with each of the six indicators at a base level of 100 – and the effect of implementing changes.[3]

By implementing changes, the company achieved:

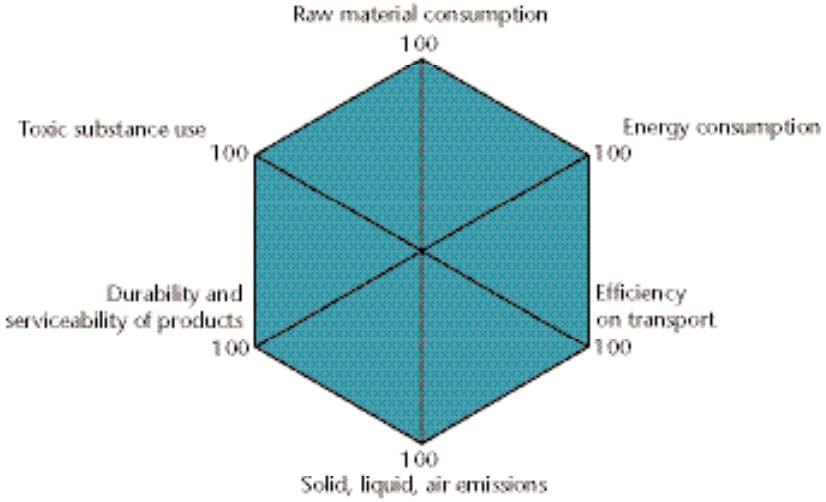
- 20% reduction in raw material consumption
- 40% reduction in energy consumption, and
- 25% reduction in solid, liquid or air emissions.

They had no change in transportation efficiency, product durability or toxicity of products.

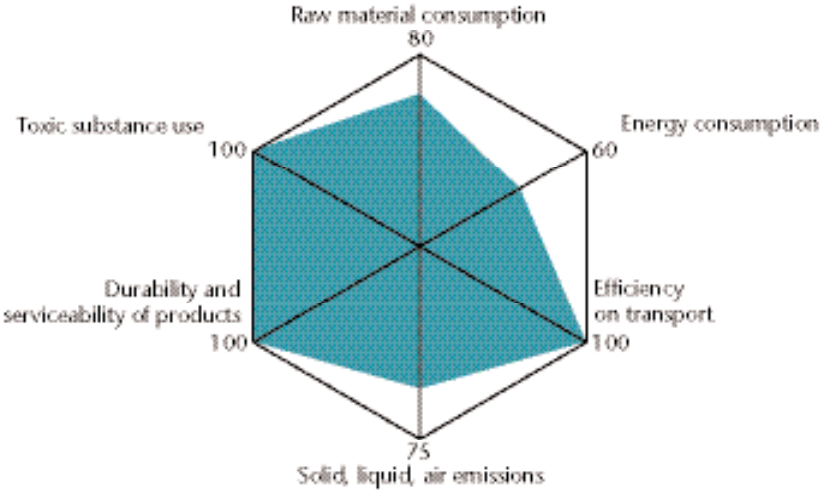
This work has been adapted with kind permission of Fundación Entorno.

[1] Dow Europe's Eco-Compass
[2] See www.fundacionentorno.org for software in Spanish
[3] Dow Europe's Eco-Compass

## Example – base case




## Example – after changes



## Purpose & learning activity

There are many ways to measure and report on eco-efficient successes. This activity demonstrates one approach. The cases are based on real studies from Fundación Entorno's experience with the Eco-Compass tool. The activity introduces some basic indicators that can be used within a company and shows how improvements can graphically be represented over time, or how impacts of different design scenarios can be compared prior to implementation.

The activity has also been designed to help the learner think through why measurement is important and what issues need to be considered.

## Materials

We provide handouts on the following pages for:

- written descriptions of 12 case studies, and
- a set of 12 cards illustrating the changes graphically.

## Facilitating the activity

Outline how the Eco-Compass tool works, using the example above to explain the base case relative to changes.

Divide the participants into groups of two to six people and give each group the written case studies and a set of 12 diagram cards showing the results of implementing changes.

The aims of this activity is to match the written case studies with the results diagrams.

If some groups finish early, give them some questions to discuss as a group – for example:

- In what (other) ways can this form of measurement and reporting be used?
- How could this be implemented? Whose responsibility is it?
- What are the limitations of this approach?

# Measuring eco-efficiency: 12 case studies

An explosives company improved the design of its product such that they eliminated entirely the use of DNT, a carcinogenic and toxic substance. The new material is produced closer to their facility so transportation has been reduced by 75%. Also, the production of the new raw material releases fewer liquid and gaseous emissions. The new explosive product has an increased detonation power, and fewer $CO_2$ and NOx emissions during use.

## Case 1

A manufacturer of automobile parts has implemented a new painting process, which includes a new type of paint. This is more durable, allowing the company to double the warranty they offer on their parts. The process changes also have resulted in a 37% decrease in material consumption and closed the water loop. Energy efficiency has also improved by 5%, and volatile organic carbon emissions generation and liquid sludges have decreased by 75%.

## Case 2

An engineering consulting company was challenged to find new water filter systems that were cost-effective in developing countries. They designed a new water filter system that reduced the cost of purification by 85%. They were able to achieve this cost reduction because energy consumption was reduced by 66% and personnel requirements by 90%.

## Case 3

A battery company sought improvements in its manufacturing process. One change was to begin sourcing supplies locally. As a result, they reduced the impact of transportation by 71%. They also began returning PVC residues to the original supplier for recycling, which contributed to a 19% savings in raw materials. Energy consumption was reduced by 5% and the toxic substance content by 27%.

## Case 4

A multinational logistics service company re-evaluated the production of shipping palettes. The original palettes were made from pinewood. A new model made from composite wood materials was designed. Not only was the new composite more durable – its life was extended by 20%, but the weight reduction of 13% resulted in transportation savings of 11%.

## Case 5

One company used the eco-efficiency concept to evaluate the physical-chemical treatment process it uses to treat residual wastes. A slight change in the chemical storage process – covering the area where chemicals were stored – resulted in a 36% reduction in atmospheric emissions that resulted from wind.

## Case 6

# Measuring eco-efficiency: 12 case studies

The principal product of one company is baking flour – semolina. One of the by-products of the process is the husk of the plant, which is currently used as cow fodder. The grinding process released a lot of air particulates, and made working conditions difficult. The company developed a new system of agglomeration of the husks. Although energy consumption increased, the atmospheric emissions were reduced and labor risks were minimized.

Case 7

This company is responsible for food catering services to several major airlines. They recognized that about 80% of the rubbish from airplane garbage bags is recoverable. They have implemented waste separation systems that have reduced waste by 47%.

Case 8

An engineering company applied the concepts of eco-efficiency to its office communications strategy. By using new technologies such as video conferencing, Internet messaging, and electronic document management systems instead of travel, the company has lessened its transportation impacts, and made slight reductions in the use of materials including paper and toner for their printers.

Case 9

This company manufactures printed professional circuits and is experienced in the preparation of the surfaces of circuit boards. They investigated, and eventually implemented, the reuse of the "bath" water from a different stage in the process. As a result, they managed to reduce the consumption of water and reagents.

Case 10

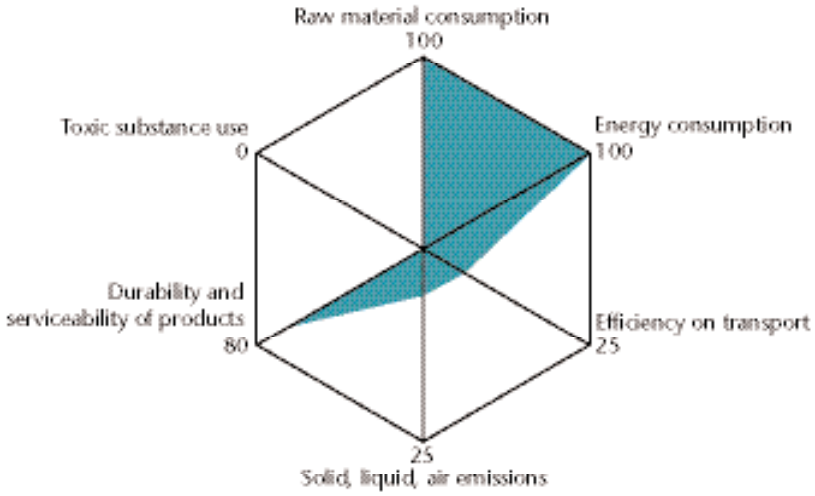
A multinational electronics company focussed on ways to reduce energy consumption at one of its assembly plants. They purchased three new air compressors of smaller capacity but which could meet the real energy demand at any moment. As a result, overall energy consumption was reduced by 45%, and the life of the equipment was lengthened.

Case 11

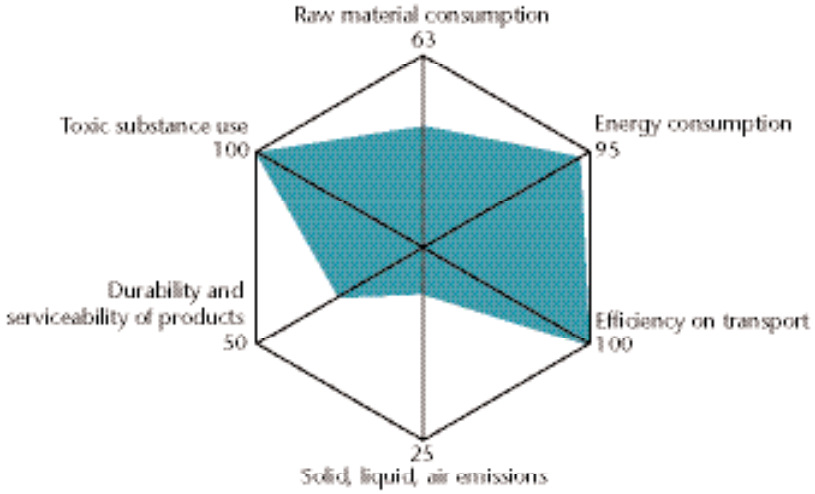
A small company manufactures parts for the transport industry. They applied eco-efficiency to the production of a fiberglass part which, when produced, released volatile organic carbons (VOC). The company decided to replace raw materials, such as the paints and resins, with ones that generate fewer emissions. The results were reduced VOC emissions and wastewater used for treatment, and the elimination of the need for production area ventilation.

Case 12

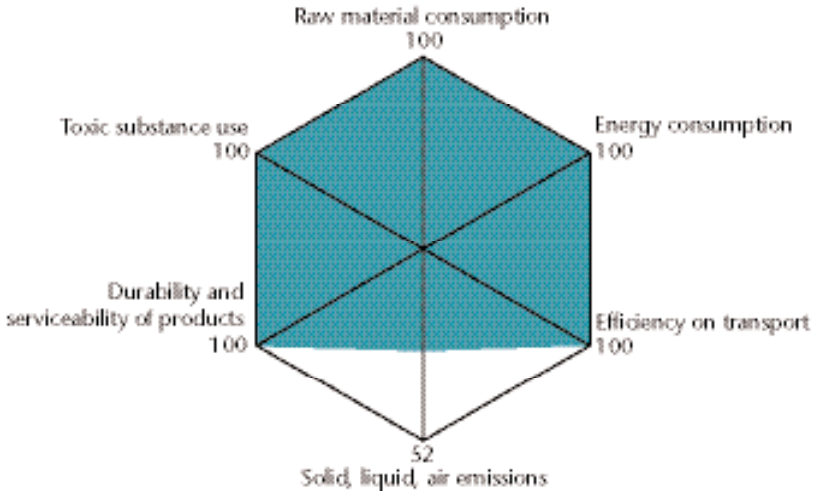
## Diagram E



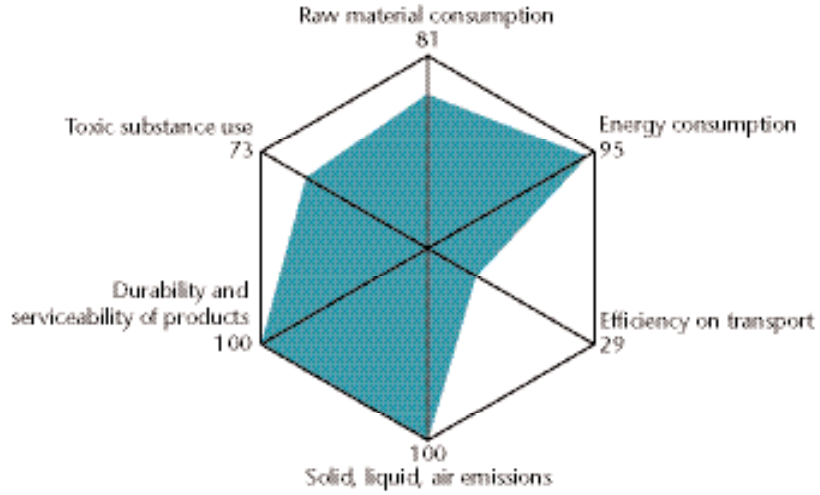

## Diagram P



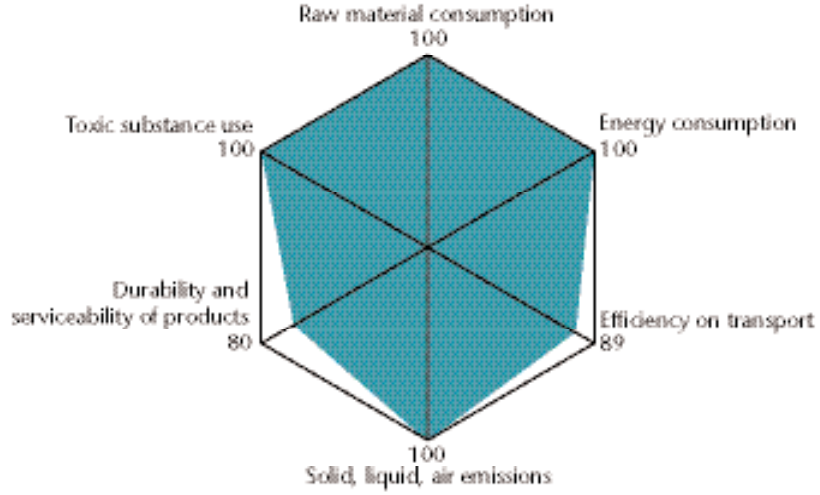

## Diagram F



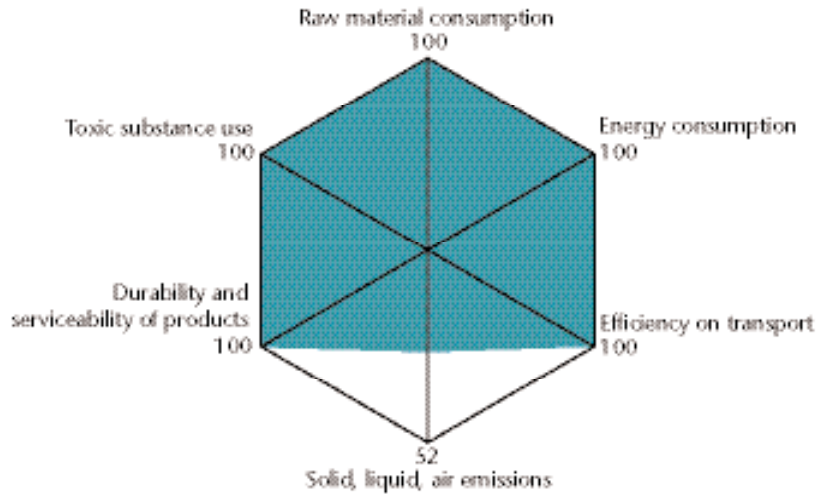
## Diagram



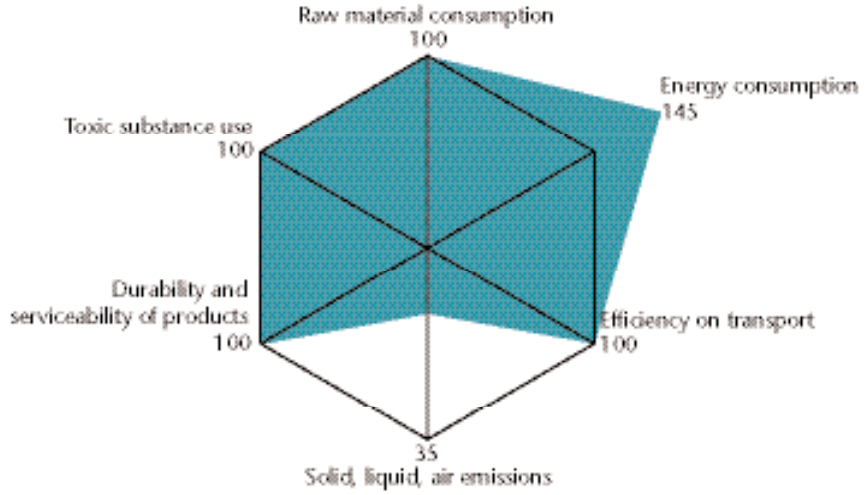

## Diagram



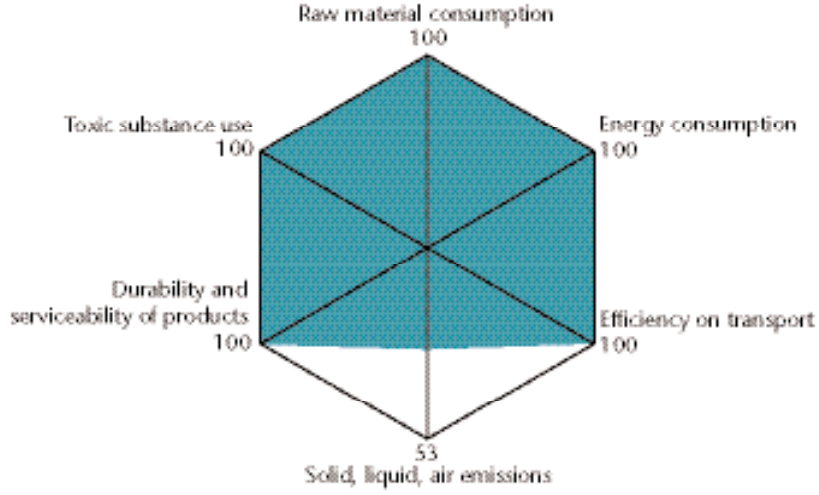

## Diagram



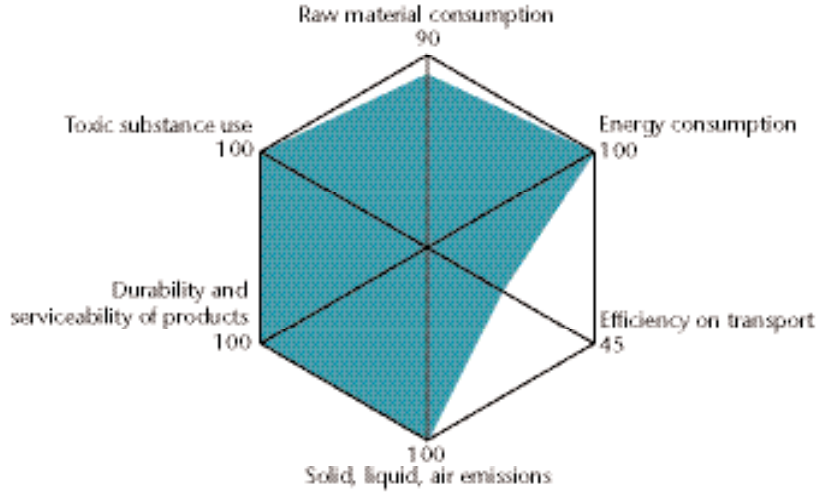
## Diagram



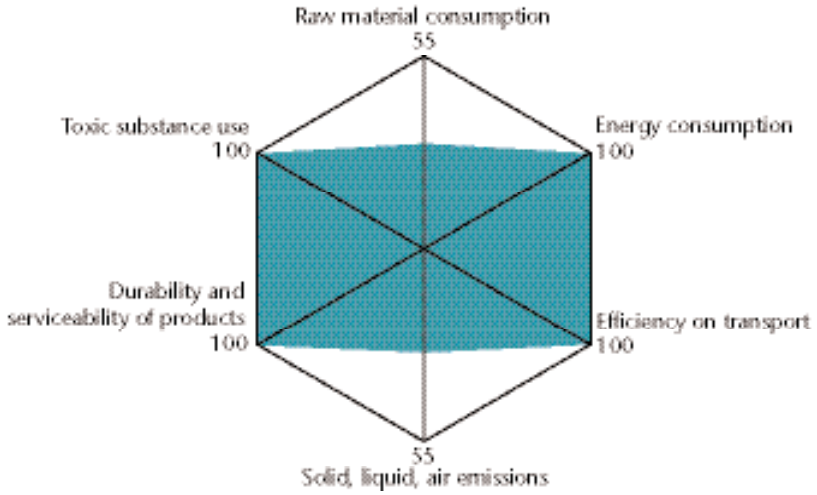

## Diagram



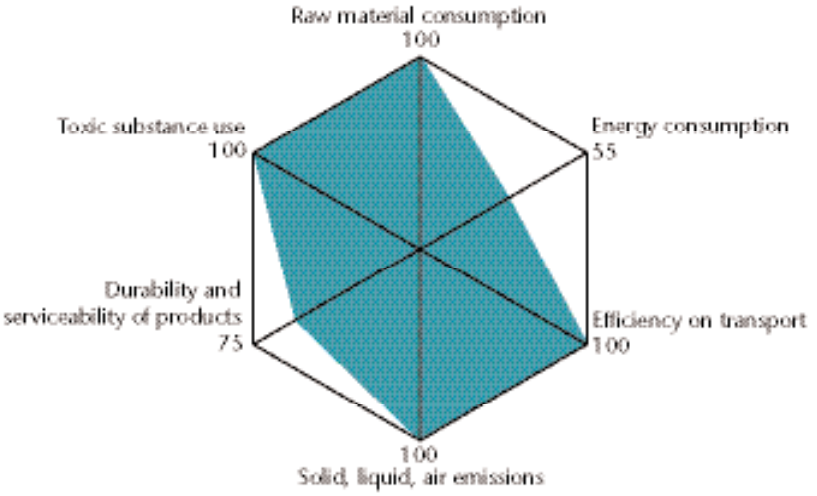

## Diagram



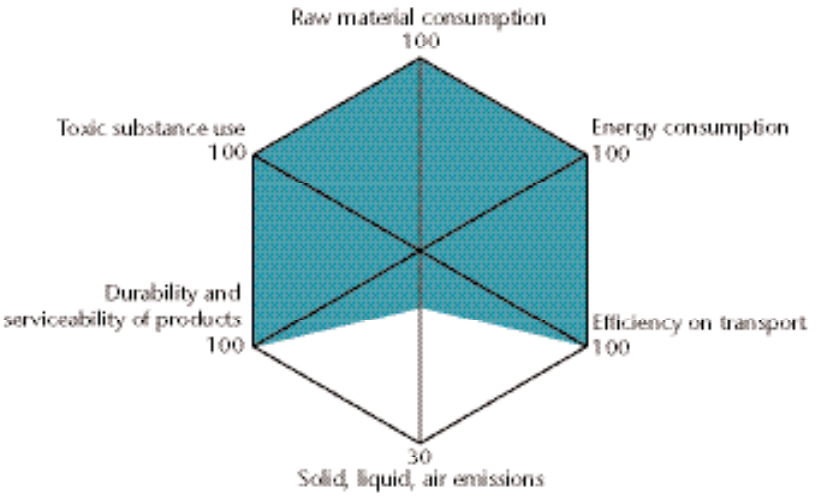
## Diagram H




## Diagram C




## Diagram K



# Measuring eco-efficiency: 12 case studies
## Answers

| | |
|---|---|
| Case 1 | Diagram E |
| Case 2 | Diagram P |
| Case 3 | Diagram F |
| Case 4 | Diagram V |
| Case 5 | Diagram T |
| Case 6 | Diagram N |
| Case 7 | Diagram B |
| Case 8 | Diagram X |
| Case 9 | Diagram R |
| Case 10 | Diagram H |
| Case 11 | Diagram Q |
| Case 12 | Diagram K |

# 5.0 Business integration

"Companies focusing on sustainable development are in better synch with market trends and society, better prepared to adapt to change and are generally better managed."
Björn Stigson, President, World Business Council for Sustainable Development

## Background

This business integration module builds on the "Understanding" and "Exploring Eco-efficiency" sections and brings the concept directly into the organization and decision-making processes of the participants. If the participants have developed an eco-efficiency profile in the Taking Stock exercise, this can be used as a starting point.

In many ways, implementing eco-efficiency in organizations is a change management exercise and it competes for attention with a myriad of other priorities and daily activities. Successfully integrating eco-efficiency requires not only a vision and strategy, but also skills, incentives, resources, tools and action plans. The exercise has been adapted from work done with Alcoa.

## Purpose & learning objective

The purpose of this exercise is to 1) have participants examine where in their organization the greatest opportunity for value creation resides from pursuing eco-efficiency, and 2) identify how they would integrate eco-efficiency into the relevant business processes.

The exercise is designed to help participants to: identify future value creation opportunities, assess their current reality (e.g. how they make decisions today), identify the optimum conditions that will ensure appropriate integration of eco-efficiency, and determine the specific actions required (e.g. identify the tools, information and/or resources required to change the business process).

## Materials

- Slide/handout presentation on eco-efficiency value opportunities
- A process description sheet that outlines what the participants should do at each stage in the exercise
- Worksheets and flipcharts to be used by the participants to record the results.

## Facilitating the activity

The activity should take about 1.5 hours (assuming a maximum of 20 participants).

Tip: The activity is ideal for a group of participants from the same company. It can be a challenge to facilitate the activity with a group of participants from many companies and sectors, because the activity asks participants to assess their company's goals and existing business processes. Participants are asked to compare current realities with a desired future situation. If you do not have a group from the same company, you may adapt the activity so that each person works individually.

**1. Review the business value slides with participants (15 minutes).**
Slide 2 outlines typical business drivers and value generation opportunities identified by companies who are pursuing eco-efficiency and sustainability. Ask participants as a group which drivers and value generation opportunities are most relevant for their organizations.

Slide titled "Typical business benefits" outlines typical business drivers and value generation opportunities identified by companies who are pursuing eco-efficiency and sustainability. Ask participants as a group which drivers and value generation opportunities are most relevant for their organizations.

Slide titled "Sustainable value model" provides some insight into the key areas where value can be, and is, generated by organizations that pursue sustainability and eco-efficiency.

Slides titled "Evolution of activity" and "Business integration" indicate that to realize the benefits outlined in previous slides, organizations must integrate eco-efficiency into their business decision-making processes. The slide titled "Evolution of activity" provides a perspective on how eco-efficiency and sustainability activities "mature" in organizations to the point where they are eventually integrated into core business processes. Slide titled "Business integration" reiterates this point in words.

**2. Conduct the exercise**
Divide the group into two or more teams (about five or six individuals per team is ideal). Try to mix people according to experience, discipline, business unit, etc.

Ask each team to identify two or three key business processes (e.g. R&D, budgeting, strategic planning, product development, sales and marketing, capital investment planning, HR performance measurement systems, etc.) where they feel eco-efficiency may offer the greatest potential value creation opportunity. Share the results of this step collectively (e.g. record on a flipchart) and assign one business process to each team (15 minutes).

Each team works on one business process and completes the following tasks:

1. Envision a desired goal or target for the priority business process (e.g. all new products would have an improved eco-efficiency profile, or the sales and marketing team would be capable of identifying market opportunities related to eco-efficiency and able to quantify and communicate those opportunities to business planning and product development).

2. Assess the current situation (this can include any challenges or barriers) in their organization (or a typical organization if they are from different companies) with respect to the decision-making process in question.

3. Identify a set of conditions that would need to be in place to achieve the goal.

4. Identify the actions, including tools, information and human or financial resources required to ensure the actions are taken (40 minutes).

Re-assemble the groups and have each team present a brief summary of their results (20 minutes).

Capture the results for distribution to all participants. See final slides (titled "Business integration template" and "Default example") for an example result.

**Option**

If all participants are not from the same company, adapt the exercise by having each person work through the tasks individually, or in partners with someone from their company. For instance, have each individual identify three key business processes, and then share everyone's results collectively by facilitating a discussion. Then ask each individual to choose one business process and work through tasks 1–6 (slide titled "Business integration exercise"). When they are done, select individuals randomly to present their answers to the group, prompt participants with similar or opposite findings to state their ideas, until a discussion ensues.

# Slides – for business integration

**Business Integration Exercise**

"Companies focusing on sustainable development are in better synch with market trends and society, better prepared to adapt to change and are generally better managed."

Björn Stigson, President of the World Business Council for Sustainable Development

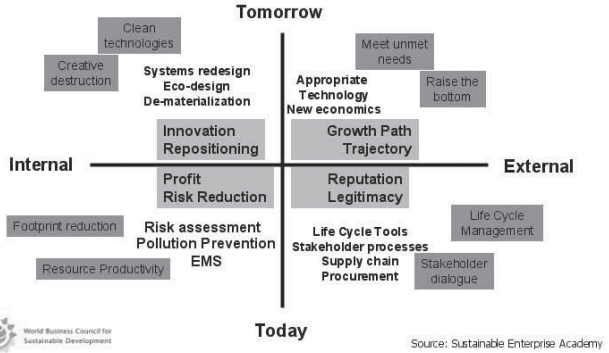
## Learning objectives

- Examine our own companies for opportunities to integrate eco-efficiency into our business processes
- Identify an approach for capitalizing on these opportunities

## Typical business benefits of pursuing eco-efficiency and sustainability

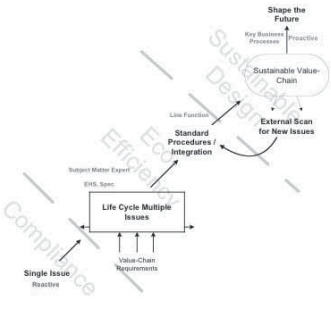
- Reputation / brand image
- Corporate values "right thing to do"
- Relations with stakeholders / dispute resolution / issues management
- Improve access to markets / customers
- Expedite permitting / relations with regulators
- Compliance with regulation (environment)
- Social license to operate / grow
- Cost savings / improved bottom line
- Stay in front of changing stakeholder expectations
- Attract & maintain skilled employees
- Increase employee morale and productivity
- Reduce business risk
- Improve reputation with investors, bond agencies, banks
- Stimulate innovation
- Input to strategic planning

## Sustainable value model




Source: Sustainable Enterprise Academy

## Evolution of activity




Source: Five Winds International Product Sustainability Round Table 2004

## Business integration

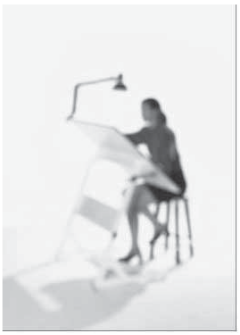
- In practice, eco-efficiency is about managing or eliminating risks, and/or creating value through
  - the measured integration of financial and environmental factors into key business processes and functions (sustainability extends this to social factors)
- E.g. product development business planning, capital allocation processes, procurement, supply chain management, facilities management, human resource systems…

World Business Council for Sustainable Development

Source: This exercise is based on an SD training exercise developed by Alcoa, with support from FWI

## Business integration exercise

1. Identify top three business processes that would benefit from better integration of environmental, and financial/economic factors.
2. Select one of the three processes and identify a goal or future vision for the business process that incorporates eco-efficiency.
3. Identify the current reality – how decisions are typically done today.
4. Identify the ideal state – what the process should look like in the future.
5. Develop actions necessary to realize the goal.
6. Review results.



World Business Council for Sustainable Development

## Business integration template

| ***Goal – desired outcome*** | ***Future vision*** |
|---|---|
| For example, procurement practices integrate eco-efficiency criteria environmental and total cost of ownership factors | • Procurement officers incorporate eco-efficiency criteria into purchasing decisions … |
| ***Current reality*** | ***Required actions*** |
| • Procurement officers drive by lowest cost option<br>• No policy on "green" purchasing<br>• … | • Tools for procurement officers<br>• Train product development team<br>• … |

World Business Council for Sustainable Development

## Business integration default example

| ***Goal – desired outcome*** | ***Future vision*** |
|---|---|
| Product development processes integrate environmental and life-cyde cost factors into early stages of the design process | • Information base available for core materials and processes on impacts and costs<br>• New concept proposals have preliminary analysis of environmental and life cycle cost<br>• Design team performance is measured in part on eco-efficiency performance<br>• … |
| ***Current reality*** | ***Required actions*** |
| • Design team not aware of impacts of product in use<br>• Design checklists/gates have no environmental information<br>• Life cycle assessment has been used on one product<br>• No life cycle costing tools available to designers<br>• …. | • Evaluate available LCA and life-cycle costing tools and select/modify as appropriate – by next quarter<br>• Develop database on materials and process by end of 200X<br>• Develop training material and train product development team – by third quarter<br>• … |

World Business Council for Sustainable Development

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# 6.0
# Assessing the limits

## Background

Eco-efficiency is an excellent management strategy that promotes environmental and economic performance. Eco-efficiency has already been widely adopted within businesses and its influence is growing. And as more people become aware of the significant business opportunities associated with eco-efficiency, its practices will grow. However, as much as eco-efficiency offers, it cannot by itself provide long-term sustainability.

Firstly, it has the limitation of relative progress. If all companies become 5% more eco-efficient each year, while the number of companies, or their output, increases by 10% each year, then we may be improving eco-efficiency at the micro-level while moving away from sustainable development at the macro-level.

Secondly, eco-efficiency companies combine only two of sustainable development's three elements – economic benefit and environmental performance – while leaving the third, social progress, outside its embrace.

It is therefore important to recognize the integrated nature of the market. The WBCSD stresses a holistic approach to markets and to sustainable development by looking at seven keys for progress within the market system:

1 Practice eco-efficiency
2 Innovate
3 Move from stakeholder dialogues to partnerships for progress
4 Provide and inform consumer choice
5 Improve market framework conditions
6 Establish the worth of the Earth
7 Make the markets work for everyone.

For more information about these seven keys for progress, please refer to the worksheet following this section.

## Purpose & learning objectives

In this activity, participants review eco-efficiency processes and its pros and cons while beginning to consider the tougher challenges associated with sustainable development.

## Materials

On the following page, we provide a handout explaining the seven keys for progress. This can be divided into seven separate cards for the activity outlined below.

## Facilitating the activity

Split the participants into groups and ask them to spend ten minutes reviewing either the advantages (pros) of eco-efficiency or the disadvantages (cons) of eco-efficiency.

Bring participants back to plenary and discuss their findings. Encourage them to discuss and consider the limitations of eco-efficiency in implementing sustainable development. The points should include:

- Eco-efficiency is limited to environmental and economic concerns, not social issues.
- Eco-efficiency has a problem of limited relative progress – it does not tackle increasing consumption levels.

Participants should identify what other factors are associated with a sustainable future. As these emerge from discussions, they should be matched with the seven keys to progress.

## Activity using the *keys to progress* cards

As a final activity, participants should choose an object – preferably one for which they have previously undertaken a life-cycle assessment (for example, a running shoe). Give each pair or small group a card with a "key to progress" on it. They should consider the product and how to apply their key to it.

For example: in the case of running shoes, eco-efficiency does not address the issue of child labor in the supply chain. Keys that might help include:

4 Inform the consumer: make people aware of the ethical dilemmas associated with child labor, and that they have influence through their purchasing power.

5 Improve market framework conditions: that might help in developing social and environmental standards globally.

Nor does eco-efficiency address the fact that many of those making the shoes can't themselves afford to buy them. Keys that might help include:

7 Make the market work for everyone: people living in poverty need purchasing power.

2 Innovation: this could reduce the cost of production.

3 Partnerships: involve other companies and agencies in tackling the problems.

# Keys to progress

## Key to progress 1

### Practice eco-efficiency

Eco-efficiency is a management strategy that incorporates a company's environmental and economic performance. The strategy enables more efficient production processes and better products and services while reducing resource use and pollution. In short, it is creating more value with less impact. Eco-efficiency can open up significant business opportunities. Its pre-eminent goal is to grow economies qualitatively, not quantitatively.

## Key to progress 2

### Innovate

Today all businesses must innovate to survive and to prosper. Both technological and social innovation can do much to improve quality of life and address the depletion of resources and the build-up of pollution around the world. Yet innovation must occur openly and companies should publicize the values that underpin their approaches to innovation. Any innovation process must be sensitive to the interests of the public.

## Key to progress 3

### Move from stakeholder dialogues to partnership for progress

The dialogue among business, civil society, and governments has matured notably since the 1992 Rio Earth Summit. Now the time has come to move beyond talking to one another to acting together for the purpose of sustainable development. Partnerships for progress are built on common goals, empathy, open feedback, flexibility, ability to compromise, and sharing rewards. Such alliances can offer business, government and civil society new solutions to common concerns.

Key to progress 4

## Provide and inform consumer choice

Consumer choice in a transparent and competitive market economy can improve everyone's quality of life. Providing choice is a key part of promoting sustainable development. Business and other stakeholders can use the media and advertising to promote sustainability messages, fostering a consumer culture that helps people wield the power of demand in a thoughtful way. Individuals can change their consumption practices if we effectively illustrate the added value from sustainable behavior in terms of financial benefits, quality of life and security.

Key to progress 5

## Improve market framework conditions

Markets depend on a stable and supportive framework of public policy. The rule of law, freedom of competition, transparent accounting standard, and a safe social context all contribute to the ability of business to create wealth. Market aspects which hinder sustainability include monopolies, corruption, perverse subsidies, and prices which do not reflect real economic, social and environmental costs. Legislation and regulations should promote competition, effective intellectual and physical property rights, reliable contractual terms, fair and transparent accounting standards, accountability for government intervention, freedom and democracy and full-cost pricing of goods and services.

Key to progress 6

## Establish the worth of the Earth

The market system needs accurate and timely price signals so that resources are not wasted and future opportunities squandered. We can improve markets so that they reflect the true cost of environmental goods and services and social impacts. Often this is by moving towards full-cost pricing – including removal of perverse subsidies. Often it is by new property regimes. Economic instruments such as tradeable permits can encourage business towards environmental improvements.

Key to progress 7

## Make the markets work for everyone

Poverty is one of the single largest barriers to achieving sustainability through the market. The 2.8 billion people living on less than $2 a day have little or no access to the market to improve their lives. The market does create enterprise and jobs, but there will be reward for companies who deliberately create more opportunities and a better quality of life for the poorest. Many of these opportunities will lie in the areas of healthcare, water, housing, nutrition, electricity, education, appliances and sanitation.

# 7.0 Planning for action

## Background

There are a range of drivers that may result in eco-efficiency practices in your company. An individual can create change at a personal, team, functional or organizational level depending on their spheres of influence and capabilities. This requires planning and perseverance, a clear understanding of what your priorities are, a recognition of your organizational strengths and weaknesses, what processes will be effective and what support you have.

The most important, and often ignored, part of a training program is to translate learning into concrete action. Every company will have their own action planning processes, so here we have made some suggestions for future actions to remind facilitators of the importance of this function.

## Purpose

To provide participants with suggestions for taking action on eco-efficiency.

## Facilitating the activity

- Hand out the worksheet to each individual and ask them to read through the action points and prioritize them. Encourage participants to take notes on why particular actions are possible and others are not.
- Participants should work in pairs and share their top three priority areas and begin to outline how this can be achieved. Points such as resources, time, networks and outputs should be considered.
- Partners should challenge participants to ensure their priorities are realistic and achievable.
- Finally, the facilitator should bring the group to plenary and share the action plans. Individuals seeking help and collaboration should have an opportunity to make a request to others and participants should be encouraged to work together if plans overlap. If time allows, it would be useful to discuss actions that participants wanted to do but felt were unachievable – see if the group can find any solutions.

# The start of a to-do list... for the proverbial Monday morning

**Actions**

Priority 1 to 3 (high to low)

- [ ] Understand the full life-cycle of your products. Pay particular attention to places where you may be vulnerable because of impacts on ecosystems.

- [ ] Establish eco-efficiency as a prominent target and evaluation screen in your innovation process.

- [ ] Test your key technologies and markets against changing trends in societal acceptance.

- [ ] Set eco-efficiency measurements and targets for your current operations and products according to guidelines.

- [ ] Start a campaign that brings eco-efficiency ideas and tangible savings to your customers and suppliers.

- [ ] Form a stakeholder advisory panel in the communities around your primary operations. Set up a stakeholder's advisory panel focussed on your main products or markets.

- [ ] Dialogue with local NGOs, UN agencies, and foundations to focus on places where traditional business models do not work. Establish partnerships to seed and incubate products and services for the poor.

- [ ] Determine who would be ideal business partners to constitute a large pool for resource-efficiency solutions exchange.

- [ ] Evaluate which of your business lines are affected by subsidies. Challenge the business to think beyond the current economic situation and develop new solutions for a time when the subsidies no longer exist. Use your stakeholder advisory panel to help create a strategy for implementation.

- [ ] Evaluate which business lines would benefit from planned resource-based economic instruments. Explore how you could mitigate negative impacts through new product and process design.

- [ ] Brief your management team on carbon permits trading and evaluate the balance of threats and opportunities on your value chain.

- [ ] Understand how suppliers, particularly from developing countries, are performing on an eco-efficiency basis. Create programs to improve performance and share rewards.

# Note pad & worksheet

Use this space for your notes and ideas

Lessons and take-away messages

# LEARNING UNIT C: IMPLEMENTING ECO-EFFICIENCY

# Resources for eco-efficiency

These resources provide reference material for facilitators, sources of further information and items that can be used directly in workshops. For example the case studies and quotes can be used to supplement or replace existing material in the learning units – select the examples that are relevant for your industry. Information such as the glossary can be given to workshop participants as handouts. For further case study examples or more detail, visit the WBCSD website: www.wbcsd.org.

# 1.0
# Case studies and examples

**BASF and an eco-efficiency tool**

BASF has developed a strategic life-cycle tool for comparing the economic and ecological advantages and disadvantages of products and processes. The tool uses a two-axis graph that plots the two values of environmental burden and total cost. When assessing environmental impacts, six categories are examined: raw material consumption, energy consumption, air and water emissions and disposal, potential toxicity, potential risks and land use. The results of eco-efficiency analysis are helping the company to improve products and processes by demonstrating exactly where improvement would benefit the environment most and what its financial consequences would be. The system also allows BASF to define and monitor research and development targets.
*www.basf.com*

**Cemento de El Salvador: furnaces and forests**

Cemento de El Salvador S.A. de C.V. (CESSA), has been using an eco-efficiency initiative to save energy and improve environmental impacts. The focus of this effort has been the installation of a new production line based on dry furnaces. Previously, three of CESSA's furnaces had been of the wet rotary type, very inefficient in fuel use. By using this new technology, installed in 1997, CESSA has decreased electricity consumption, $CO_2$ emissions, and nitrous oxide particulates since dry furnaces use less energy. CESSA is also reforesting an average of four hectares per year, and each hectare of forest offsets four tons of $CO_2$ emissions. Many of the reforested areas were former mining pits, abandoned roads, or simply lands that had been deforested.
*www.cessa.com.sv*

**Chaparral Steel Company: Recycling wastes from steel and cement manufacturing**

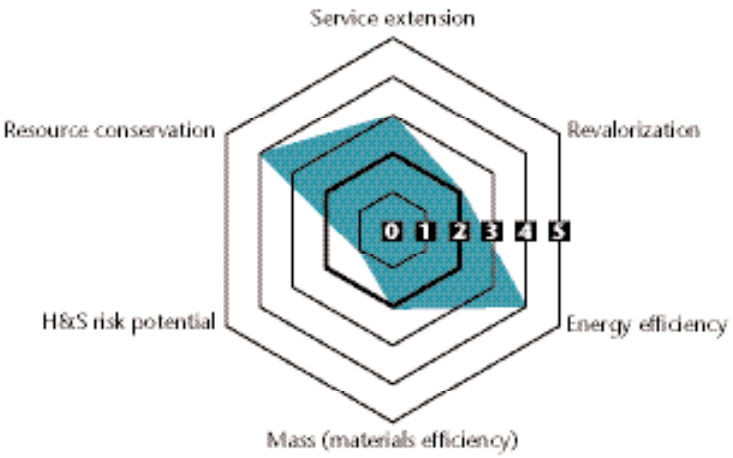
Chaparral Steel Company initiated its "Systems and Technology for Advanced Recycling" (STAR) program jointly with TXI Cement, to process wastes, conserve natural resources and prevent pollution, through the recycling of waste materials generated by steel and cement manufacturing. As part of the STAR project, Chapparal and TXI Cement patented "CemStar", a process that adds slag, or stony waste matter separated from metals during smelting or refining of ore, to the raw material mix, yielding larger batches of high-quality Portland cement without compromising its characteristics. This by-product-to-resource conversion conserves natural resources while reducing energy requirements by at least 10%, reducing $CO_2$ and NOx (oxides of nitrogen) emissions. Furthermore, the value of the slag has risen by a factor of 20 relative to its value as a road construction material, its previous use, and TXI believes most cement kilns can increase their capacity by 5% to 15% with a very small capital investment and low incremental costs.
*www.chaparralsteel.com*
*www.deh.gov.au/industry/index.html*

**CH2MHILL and Nike: eco-efficiency through supply chain metrics**

Nike's large and diverse supply chain vendors are part of its sustainability initiative which aims to preserve and conserve water and reduce the environmental impacts of wastewater discharge in production operations. CH2MHILL has worked with more than 250 of these vendors to develop a database, issue reporting forms to factories, collect and validate quarterly data from factories, and generate quarterly corporate environmental reports. Under the program, CH2MHILL established a baseline for solid waste produced in 45 footwear factories in Asia. The goal is to reduce solid waste production and increase recycling, while documenting and reporting on progress.
*www.ch2m.com www.nike.com*

**Dow Europe's Eco-Compass**

Dow Europe has developed "Eco-Compass", a tool used by product and process designers to characterize new products against former versions of the products of their competitors. A rank of 2 means it is the same, 0 is a factor of two worse, 4 a factor of two better, and 5 a factor of 3 better.
*www.dow.com*




Dow Europe's Eco-Compass

**DuPont: Reducing toxic emissions**

A DuPont agricultural products team from LaPorte, Texas, reduced its toxic emissions by 99% through closed-loop recycling, off-site reclamation, selling former wastes as products, and raw material substitution. Overall savings included $2.5 million in capital and more than $3 million in annual operating costs.
*www.dupont.com*

**DuPont's targeted environmental goals**

A focus on targeted environmental and energy goals has resulted in a 91% reduction in global air carcinogens, a 47% reduction in global hazardous waste, flat energy use for the past decade while production increased over 30%, and a 68% reduction from 1990 in $CO_2$-equivalent greenhouse gas emissions from its global manufacturing operations.

While DuPont has clearly made substantial investments to achieve these results, it has also reduced its remediation and end-of-the-pipe waste treatment costs by

over $250 million per year compared to a decade ago. DuPont has saved over $1.5 billion in energy costs compared to where the company would be today if energy use increased linearly with production. DuPont has also generated over $40 million in fairly near-term revenues from the sale of greenhouse gas emission reduction credits.
*Chad Holliday before the TERI Delhi Sustainable Development Summit*

**Fundación Entorno: Eco-efficiency kit**

In 1999, the Spanish partner organization Fundación Entorno launched a pilot project with 12 Spanish companies to demonstrate the viability of products, processes, and services developed through eco-efficiency conceptualization. As a result of this work, the Eco-Efficiency Toolkit 1.0 software was developed to help companies improve and quantify their eco-efficiency. The three modules look at eco-design, baseline and eco-efficiency.

The Eco-Efficiency Toolkit 1.0 has been sent to more than 800 companies. Results include:

- The electrical engineering and electronics company SIEMENS, AG used this toolkit for its Barcelona factory, which makes train, subway, and streetcar engines. Siemens conducted an analysis of processes and products developed in-house to determine which of these required further improvements, focussing particularly on processes that used a lot of energy. The study helped the company select alternative technologies that have simplified construction, cut energy consumption by 45%, extended the working lives of key machinery and saved 8,803.70 euros ($7,847).
- One of Spain's largest consulting groups, TYPSA Group, used the Eco-Efficiency Toolkit 1.0 to analyze a water purification plant for a developing country project. The kit helped them to identify and introduce eco-efficiency improvements in each activity throughout the process and assign environmental costs. Energy consumption was improved by 66% and the cost of the final product improved by 85% – demonstrating the benefits of eco-efficiency in developing countries.

*www.fundacion-entorno.org*

**Hewlett-Packard: Using recycled HP products**

In 2003, HP met its goal to introduce a hardware product containing recycled material content recovered from end-of-life HP products. Engineers from multiple product lines teamed up with HP's Planet Partners™ recycling team to develop and qualify a plastics formulation that could replace virgin plastic with material obtained from HP end-of-life products. The team developed a material called recycled polyethylene terephthalate (RPET). RPET is a blended material that contains plastic from HP print cartridges recycled in HP's Planet Partners™ program and post-consumer recycled plastic drinking bottles. RPET is used at full production levels in the carriage cover for two HP scanners, the ScanJet 4500 and 5550. This reduces virgin materials use, and with additional volumes and experience, it could lead to cost savings. Two additional scanners using the recycled material were launched in 2004. One of these models is expected to use about 100 tonnes of RPET during the next two years.

**Hitega and eco-efficiency**

Hitega (Hilados y Tiejidos Garib), a Chilean textile mill producing dyed yarn and fabric made of polyester and rayon, used eco-efficiency to identify improvements in the use of water and energy, and the amount of suspended solids in the effluent stream. Some results included recycling the softened water used to cool the dye bath; recycling the water supply for air conditioners in the spinning and weaving rooms; and improving softener regeneration and service. It also installed screens in dye room drains to reduce the amount of suspended solids in effluent (liquid waste or sewage discharged into a river or the sea), and revamped its maintenance plan to address leaking steam traps. The resulting environmental benefits of these initiatives were water, energy and chemical conservation, and reduced emissions and effluent-borne solids. Most of the measures adopted had payback periods of two years or less. The recycling of dye cooling water, for example, cost $750 but delivered savings of $400 a year.
*www.hitega.cl*
*www.bsdglobal.com/viewcasestudy.asp?id=71*

**Minetti Group: Using waste as fuel in cement kilns**

The Argentine company Ecoblend, part of the Minetti Group of cement companies, has developed a technology to use industrial waste as a fuel in cement kilns. This alternative fuel process has several benefits. It conserves fossil fuels such as gas or diesel. It saves companies the chore of disposing of some of their own wastes, and it removes wastes from the environment, with no leftover material such as ash, which is often the case with other technologies. The process also contributes to the reduction of carbon dioxide, sulfur and nitrogen oxide emissions. The use of these waste products in cement kilns avoids emissions that would be generated through incineration. Since 1997, the use of industrial refuse as an alternative fuel in cement kilns in Argentina has saved 49,350 $m^3$ of fossil fuels and a total of 122,500 tons of industrial waste from landfill.
*www.ecoblend.com.ar/viewpg.asp?Cod=420*

**Norsk Hydro: Aluminum recycling**

Norsk Hydro adopted a life-cycle analysis approach to aluminum production, evaluating production and potential eco-efficiency opportunities from a value chain and systems perspective. In particular, life-cycle analysis revealed that the recycling of aluminum saves up to 95% of the energy used for primary production. As a result, the company began to develop its recycling and remelting concept for aluminum. During the 1990s, the company substantially increased its remelting capacity to increase the amount of recycled aluminum provided. In 1992, remelted aluminum accounted for 180,000 tons, while primary aluminum levels were much higher, at 610,000 tons. By 2001, primary levels had grown by 29% as a result of the increase in demand to 800,000 tons. However, the recycled and remelted content grew by more than 400% in the same period to 750,000 tons.
*www.hydro.com/en*

**Philips Lighting's compact fluorescent light bulb technology**

Philips Lighting invented a product that is offering considerable energy and cost-saving potential. Compact fluorescent light bulb technology offers lamps that last 10 times longer and use 75% less energy than incandescent bulbs. This technology has the potential to make considerable differences in energy consumption – and costs. For example, it is projected that New York's Times Square could save 23 million kWh and $5.8 million annually with the bulbs and the Strip in Las Vegas could save 105 million kWh and $8.4 million annually. *www.lighting.philips.com*

**SC Johnson's Greenlist™ for choosing ingredients**

SC Johnson's Greenlist™ process helps make better environmental choices as they formulate products. The Greenlist™ is the number one Environmental Initiative in SC Johnson's Five Year Strategic Environmental Plan. Tracking the results of its Greenlist™ process for several years, SC Johnson has a number of good stories. The following represent success in two of its major brands.

Through the Greenlist™ process, SC Johnson developed a new formula for its Windex® window cleaner. The new formula uses raw materials that are better for the environment and exceeds consumer expectations by not streaking and being easy to wipe. The goal for reformulating the product was to improve cleaning performance while reducing volatile organic compounds (VOCs). In 2002, 181,800 kg of VOCs were removed from the formula while maintaining the "streak-free" formula. In 2004, another 818,000 kg of VOCs were removed and cleaning performance was improved by 30%. This was done using a patentable combination of surfactants, solvents low in VOC content and a unique polymer. At the same time SC Johnson removed a volatile organic solvent called 2-butoxy ethanol that was recently classified as "toxic" under the Canadian Environmental Protection Act. Since the new formula was introduced in September 2005, Windex® sales have increased by 8% and market share has increased 3.9 points.

**SC Johnson: Reducing waste, risk and cost**

In the 1980s and 1990s, the company focussed on eco-efficiency by reducing waste, risk and cost, and by creating management systems to measure reductions. Between 1990 and 1995, production increased by 50%, while waste emissions were cut by half. In the past 10 years alone, the company has cut wastes from products and processes resulting in annual cost savings of more than $125 million. *www.scjohnson.com*

**Sonae: Shopping mall innovation**

Sonae distinguishes itself from other Portuguese shopping mall competitors through innovation. Through the use of more daylight and low-energy light fittings, enhanced building management systems, a cheap and innovative cooling system, and natural gas and co-generation systems, Sonae is saving money and the environment. Additionally, 50–75% of the wood used in its wood panel business consists of wood wastes and by-products. At one shopping center it has designed innovative waste collection, handling and recycling schemes that take place underground, out of sight. At the same site, air-conditioning is achieved by continuous watering of a 110-meter-long glass skylight. This lowers

ambient temperature while creating a crowd-pleasing visual effect as sunlight backlights the water flowing across the glass.
*www.sonae.pt*

**Sony's new repair scheme**

Miniaturization and the shift to digital technologies have made product repair an increasingly difficult and specialized job. In Europe, Sony has introduced an exchange and refurbishing program for the repair of products with large sales volumes. Since the inception of this program, costs have been reduced by 25%.
*www.sony.net/index.html*

**Taiheiyo Cement Corporation: Eco-cement**

The company has developed an eco-cement process that uses waste from society and other industries, and in which dioxins and harmful heavy metals are captured. Through the manufacture of eco-cement, the company contributes to both energy conservation and $CO_2$ reductions.
*www.taiheiyo-cement.co.jp*

**TEPCO: Eco-efficient energy**

The Tokyo Electric Power Company (TEPCO) has implemented various $CO_2$ emission reduction measures both on the supply and demand sides. On the supply side the company has been working to improve the efficiency of thermal power generation and to reduce transmission and distribution loss rates. These improvements, coupled with hydroelectric production, reduce fuel costs and the use of valuable resources. These efforts also reduced $CO_2$ emissions in 2000 by the equivalent of about 14.6 million tons compared to 1990. On the demand side, TEPCO promotes and supports the energy conservation efforts of its customers to enhance overall energy efficiency. In October 2000, based on surveys of its consumers' willingness to pay for renewable energy, TEPCO launched its "Green Power Fund" to further promote renewable energy.
*www.tepco.co.jp*

**Unilever: Project Medusa to save water**

Unilever has many manufacturing operations in Latin America – a region experiencing problems of water availability. As water is an essential utility or ingredient to Unilever's processes, the company challenged its foods manufacturing sites to reduce their water imprint by 1,000,000 $m^3$. Project Medusa was launched in April 2003. The project involved training site engineers and safety/health/environment coordinators at the 17 foods manufacturing sites on eco-efficiency as well as at a two-day workshop. The engineers and coordinators contributed examples of good water optimization practices and shared their experiences. Sites then selected the good practices that applied to their operations and estimated their expected water savings – the site's "Medusa contract and action plan" for water savings. Monitoring, site water balances and additional metering at each site are also key parts of project Medusa.

Unilever's largest manufacturing site in the Goiânia region in Brazil has reported water savings of over 500,000 $m^3$ due to the implementation of its Medusa action plan. In total the current estimate of water savings overall in Latin America is approaching the target of 1,000,000 $m^3$.

### UTC: Teamwork to flag valuable improvements

One of United Technologies Corporation's sites eliminated almost 40,000 gallons per year of waste water and saved over $50,000 per year with a fundamental change in the way its manages its test cells, underground storage tank and waste streams. To achieve this, the site now only uses its underground tank for emergency purposes – and not for regular waste or water, as it was doing. It also collects waste fluids (fuels and oils) separately for re-use, recycling or reclamation. Given these changes, the site anticipates it will eliminate an additional 75,000 gallons of waste per year and save $150,000 per year.

These eco-efficiency improvements were identified during one of UTC's Kaizen events. UTC conducts environment, safety and health Kaizen events across its sites to drive continuous improvement in its environmental, health and safety performance. The event focuses attention on specific processes and the Kaizen team consists of all parties interested in that process, from management to operators. The team conducts a structured, focused evaluation of a manufacturing or service process, integrating Kaizen techniques and flexible manufacturing problem-solving techniques with EH&S risk assessment. The purpose of the events is to identify and eliminate or reduce environmental, health and safety hazards.

### The Warehouse's Energy Management Team

New Zealand retailer The Warehouse's Energy Management Team has been saving the company a lot of money. The team has designed a software program that automatically controls lighting, heating and air conditioning allowing the entire chain to be operated from one central office. Colored screen displays give 3-D representations of the stores, their floor plans, and the configuration and status of the lighting, heating, ventilation, air-conditioning and other energy-using equipment, providing a user-friendly interface for staff. Energy consumption, measured every half hour in each store, is available on a secure website run by a metered supplier. The stores have no light switches – all is controlled by the system, which responds to the lighting levels and time of day. Over seven years the air-conditioned volume of stores increased dramatically, but was not matched by a similar rise in power usage. In fact, average power consumption dropped from an original 200kWh/$m^2$ to 100kWh/$m^2$.
*www.thewarehouse.co.nz*

# 2.0
# Glossary and acronyms

**Agenda 21**

Agenda 21 is a comprehensive plan of action to be taken globally, nationally and locally by organizations of the United Nations System, governments, and major groups in every area in which humans impact the environment. The full implementation of Agenda 21, the program for Further Implementation of Agenda 21 and the Commitments to the Rio principles were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in 2002.
*www.un.org/esa/sustdev/documents/agenda21/index.htm*

**By-product synergy**

Means using the by-products and wastes of one industry as raw materials and resources for another – thus creating zero waste.
*www.wbcsd.org*
*www.usbcsd.org*

**Cleaner Production**

Cleaner Production (CP) is the international term for reducing environmental impacts from processes, products and services by using better management strategies, methods and tools. In doing so, the consumption of natural resources, pollution and waste are reduced, bringing both financial and environmental benefits.
*www.cleanerproduction.com*

**Design for the Environment (DfE)**

The Design for the Environment (DfE) program works with individual industry sectors to compare and improve the performance and human health and environmental risks and costs of existing and alternative products, processes, and practices. Also known as "ecodesign", this approach examines a product's entire life-cycle and proposes changes to how the product is designed to minimize its environmental impact during its lifetime, integrating cleaner, cheaper, and smarter solutions into everyday business practices.
*www.epa.gov/dfe*

**Eco-capacity**

Refers to the economic carrying capacity of the earth. Difficult to calculate but it is clear that limits are being reached.
*DeSimone, L. and Popoff, F., Eco-efficiency – The Business Link to Sustainable Development, MIT Press, 1997*

**Eco-efficiency**

The delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life-cycle, to a level at least in line with the Earth's estimated carrying capacity.
*www.wbcsd.org*

**Eco-efficiency indicators**

At the company level, eco-efficiency indicators can be used to provide a measure of a business's resource efficiency, i.e. how efficiently such resources as energy, water and key materials are being transformed into saleable products. The WBCSD suggests that eco-efficiency be expressed as a ratio of product or service value per environmental influence.

**Eco-innovation**

Eco-innovation refers to the integration of environmental sustainability into key business activities by ensuring that environmental factors are accounted for in product design.
*www.unilever.com/environmentsociety/environmentalmanagement/ecoinnovation*

**EEA**

European Environment Agency

**EIONET**

European Environmental Information and Observation Network

**EMS**

Environmental Management System

**Environmental accounting/full cost accounting**

Environmental accounting is the process of assessing the full spectrum of costs and benefits associated with the implementation of pollution prevention measures and other environmentally friendly procedures.
*www.epa.gov/ebtpages/econenvironmentalaccounting.html*

**Environmental Impact Assessment**

The process of predicting and evaluating the effects of an action or series of actions on the environment, then using the conclusions as a tool in planning and decision making.

**Environmental indicators**

Environmental indicators are used as an information tool allowing the measurement of environmental trends. Indicators can provide both a snapshot of a current situation and the means to observe changes over time. Environmental indicators are being developed at many different levels – from the individual company to sectoral and national indicators.

**Environmental Management System (EMS)**

An environmental management system is a tool for managing the impacts of an organization's activities on the environment. It provides a structured approach to planning and implementing environment protection measures. An EMS integrates environmental management into a company's daily operations, long-term planning and other quality management systems.

**Factor Four**

Introduced in 1998 by the Rocky Mountain Institute, Factor Four refers to a hypothetical fourfold increase in "resource productivity", brought about by simultaneously doubling wealth and halving resource consumption. It goes on to illustrate technologies that can deliver the necessary improvements.

**Green taxes**

An economic instrument for steering economies toward better environmental health. By taxing products and activities that pollute, deplete or otherwise degrade natural systems, governments can ensure that environmental costs are taken into account in private decisions.

**Industrial ecology**

Seeks to treat industrial systems in a manner analogous to ecological systems in nature, as an artificial ecosystem, with primary sources of raw materials and energy and with a number of enterprises making use of what would otherwise be waste products of other members of the system (synonymous with by-product synergy).
*Manahan, S., Industrial Ecology, Environmental Chemistry and Hazardous Waste, 1999*

**Life-cycle analysis (LCA)**

A systems-oriented approach to product design that aims to calculate the total environmental impact of a good, process or service throughout all stages of its life-cycle, "from cradle to grave". This is achieved through the compilation of an "inventory" of energy and resource usage, waste generation, emissions and discharges. LCA can be used to compare the relative environmental merits of particular product categories (e.g. washing machines), such as under the EU eco-label.
*www.lcacenter.org*
*www.life-cycle.org*

**Performance-based contracting (PBC)**

PBC is a technique that has been mainly utilized in the energy industry, whereby contractors approach firms with proposals to improve their energy efficiency. The contractors receive payment only according to efficiency gains achieved. This approach can be used for many aspects of a firm's inputs and outputs – water, transport, waste, chemicals, etc.

**Sustainable consumption**

"The use of goods and services that respond to basic needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of waste and pollutants over the life-cycle, so as not to jeopardize the needs of future generations."
*Norwegian Ministry of Environment, 1994*

**Sustainable development**

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs." (*Our Common Future*, 1987.) More specifically, if development is to be sustainable, then it needs to protect the following three elements of human life: the environment and natural resources, social equity and the economy.
*www.wbcsd.org*

**Sustainable production**

If sustainable development is to be achieved, production processes, products and services have to be oriented towards new patterns, in order both to alleviate environmental stress and to achieve more efficient industrial productivity. This will require the development and use of new policy and management tools in both government and industry, as well as the development and use of environmentally sound technologies, with a focus on cleaner and safer technologies that prevent pollution and use raw materials efficiently.
*www.unep.org/unep/sub21.htm*

# 3.0
# Quotes and speeches

"Eco-efficiency catches at a glance the balance business strives toward: sound ecology and profitable operations."
*Bjorn Stigson, president, WBCSD (Walking the Talk)*

"Business cannot achieve eco-efficiency alone. Progress requires going beyond the internal actions of companies; it needs governments to create an enabling framework which allows individual companies and markets to become more eco-efficient."
*Bjorn Stigson, president, WBCSD – The World Bank Group Environment Strategy, June 6, 2001*
*www.wbcsd.org/DocRoot/41GhZ9EHj28TqoLfGJpk/ee-bs-worldbank.pdf*

"The concept has moved from preventing pollution in manufacturing industries to becoming a driver for innovation and competitiveness in all types of companies. Eco-efficiency applies throughout a company. It is not limited to areas within a company's boundaries, such as in manufacturing and plant management. It is also valid for activities upstream and downstream and involves the supply and product chains."
*Bjorn Stigson, president, WBCSD – The World Bank Group Environment Strategy, June 6, 2001*
*www.wbcsd.org/DocRoot/41GhZ9EHj28TqoLfGJpk/ee-bs-worldbank.pdf*

"My colleagues and I are totally committed to a business strategy that generates profits while contributing to the well-being of the planet and its people. We see no alternative."
*Mark Moody-Stuart, chairman, Shell*

"Environment will represent one of the biggest possibilities for technical and leadership-based innovation – and profitable companies – which the world has ever witnessed."
*Percy Barnevik, ABB, The World Bank Group Environment Strategy*
*www.wbcsd.org/DocRoot/41GhZ9EHj28TqoLfGJpk/ee-bs-worldbank.pdf*

"Just as the Stone Age did not end for a lack of stones, the Oil Age will not end for a lack of oil."
*Preserving the Environment and Raising Living Standards Through an Open Food System.*
*Incorporated to the 32nd International General Meeting Pacific Basin Economic Council. Ernest S. Micek, chairman and CEO, Cargill, May 18, 1999*
*www.cargill.com/today/speeches/micek3.htm*

"We can support SMEs' adoption of eco-efficiency in two main ways. First is the reinforcement of the supply chain management. The larger companies can play a very important role in encouraging its SME suppliers to practice eco-efficiency. Second is the support by the government, including training, financing and incentives."
*Yao Sheng Chen, chairman, Taiwan Prosperity Chemical Corp. and Taiwan Cement Group*

"If it is better, and more profitable, to do things responsibly, people will do things responsibly. But without the right framework and structures in place, the motivation will be lacking. Because there is generally little pressure from authorities or civil society, many small or medium-sized businesses practice business in an informal way. They don't pay taxes; they obtain water or energy illegally; and they don't pay social security or minimum wages. And that way they can start out with a lower cost structure than a competitor who is determined to do things legally. This is why it is so important to set the right framework so that others don't get a free ride."
*Maria Emilia Correa, vice president of Social and Environmental Responsibility, GrupoNueva (Walking the Talk)*

"Eco-efficient innovations allow companies to use a range of inputs more productively – from raw materials to energy to labor – thus offsetting the costs of improving environmental impact. Ultimately, this enhanced resource productivity makes companies more competitive, not less."
*Michael Porter*

"Bearing in mind the nature of our businesses, we founded the long-term performance strategy for Suez Lyonnaise des Eaux on eco-efficiency. This concept links competitiveness and value creation to protecting the world's equilibrium and enhancing our understanding of environmental challenges. Sustainable growth must thus be part of business strategy, integrated in all decision-making processes, and demonstrated through concrete action."
*Thierry Chambolle, senior vice president, Environment and Technology, Suez Lyonnaise des Eaux*

"Our experience shows that sustainability does not require sacrifice or deprivation. Rather it means exploiting the latest technologies, reducing waste, reusing resources, adopting lean production and better logistics practices and making sound investments in efficient productive capacity. In fact, eco-efficiency and sustainability are not free; for a market leader they are actually more than free because they provide a real competitive advantage."
*Pasquale Pistorio, president and CEO, ST Microelectronics*

## RESOURCES FOR ECO-EFFICIENCY

"Our business challenge is to deliver competitive economic value, and at the same time operate in an environmentally sound and socially responsible manner. I strongly believe that excellence in environmental approach and solutions, in social responsibility and in economic performance are complementary, and not conflicting. In periods with substantial and rapid business restructuring, the need to provide practical proof of this complementarity is becoming increasingly important."
*Egil Myklebust, president and CEO, Norsk Hydro*

# 4.0 Organizations and websites

## CLEANER PRODUCTION

**The Chemical Strategies Partnership**
Non-profit organization seeking to reduce chemical use and chemical risks "by redefining the way chemicals are used and sold".
*www.chemicalstrategies.org/mission_and_goals.htm*

**Clean Production Action**
International network dedicated to the advancement of sustainable production and consumption.
*www.cpa.most.org.pl/cpa.html*

**Journal of Cleaner Production**
Interdisciplinary forum for the exchange of information on the technologies, concepts and policies behind cleaner production, published six times a year.
*www.elsevier.nl/locate/jclepro*

**UNEP cleaner production activities**
Definitions, research and case studies from the UN Environment Programme, including a list of signatories to the UN Declaration on Cleaner Production.
*www.unepie.org/pc/cp/home.htm*

**UNIDO Cleaner Production Centers**
Aims at building capacities, fostering dialogue and government, and enhancing investments for transfer and development of environmentally sound technologies.
*www.unido.org/doc/4460*

## BY-PRODUCT SYNERGY AND INDUSTRIAL ECOLOGY

**The American Council for an Energy-Efficient Economy**
Research and training organization set up to promote energy efficiency in the USA through collaborations with different sectors.
*www.aceee.org*

**Indigo Development**
An organization tackling sustainable development through industrial ecology using policy, tools, case studies and research for the private and public sectors.
*www.indigodev.com/IE.html*

**International Society for Industrial Ecology**
The ISIE is to promote the use of industrial ecology in research, education, policy, community development and industrial practices.
*www.is4ie.org*

**The Journal of Industrial Ecology**
Quarterly journal launched in 1997.
*http://mitpress.mit.edu/catalog/item/default.asp?ttype=4&tid=32*

**UK BCSD**
UK business action-based network focussed on the application of sustainable development with an active industrial symbiosis programme.
*www.bcsd-uk.co.uk*

**US BCSD**

Non-profit business association with by-product synergy initiatives all over North America.
*www.usbcsd.org*

## LIFE-CYCLE

**American Center for Life Cycle Assessment**

In 2001, the Center was formed to build capacity and knowledge of LCA in industry, government and other organizations.
*www.lcacenter.org*

**Center for Sustainable Systems**

Based at the University of Michigan, this center develops life-cycle-based models and sustainability metrics to evaluate the performance and to guide the improvement of industrial systems for meeting societal needs.
*http://css.snre.umich.edu/index.html*

**SETAC Life-Cycle Assessment (LCA) Advisory Group**

The Society of Environmental Toxicology and Chemistry has established the SETAC LCA Advisory Group. Its mission is to advance the science, practice, and application of LCAs to reduce the resource consumption and environmental burdens associated with products, packaging, processes or activities. It does this through various forums, publications and newsletters with chapters in North America and Europe.
*www.setac.org/lca.html*

## BUSINESS INSTITUTIONS

**BSD**

International Institute of Sustainable Development's business and sustainable development website with strategies and practical solutions for companies.
*www.bsdglobal.com/tools/bt_eco_eff.asp*

**European Business Council for a Sustainable Energy Future**

An alliance of business leaders committed to developing more sustainable and secure sources of energy, with a focus on renewable energy, CHP and Climate Change.
*www.e5.org*

**WBCSD**

International business organization committed to leadership in sustainable development. Coined the term eco-efficiency.
*www.wbcsd.org*

**World Resources Institute**

World Resources Institute is an independent non-profit organization working to protect the Earth and improve people's lives.
*www.wri.org/wri/meb/sei/beyond.html*

**World Economic Forum**

An independent international organization committed to improving the state of the world, particularly through convening meetings and dialogue with corporate members.
*www.weforum.org*

**International Institute on Sustainable Development**
IISD participates in policy dialogue and undertakes research on issues of international trade and investment, economic policy, climate change and natural resource management.
*www.iisd.ca*

**World Environment Center (WEC)**
The World Environment Center (WEC) is an independent, not-for-profit organization working with the private sector, international organizations, non-governmental organizations and academia, and sustainable development issues, including eco-efficiency.
*www.wec.org*

**Wuppertal Institute**
The Institute, based in Germany, develops guiding principles and concepts in the areas of energy, transport, material flows and structural change, and eco-efficient enterprises.
*www.wuppertal.de*

## GOVERNMENTAL ORGANIZATIONS

**Australian Eco-efficiency and cleaner production**
Set of tools, case studies and materials on cleaner production and eco-efficiency compiled by the Australian government, aim to protect and conserve the natural environment.
*www.deh.gov.au/settlements/industry/corporate/eecp/index.html*

**Cleaner Production China**
The site provides a thorough list of references on cleaner production and eco-efficiency.
*www.chinacp.com/eng/cp_tools.html*

**The US Department of Energy**
Sector-specific advice and information on energy efficiency.
*www.energy.gov*

## INTERGOVERNMENTAL ORGANIZATIONS AND INITIATIVES

**European Eco-efficiency Initiative (EEEI)**
An initiative of the World Business Council for Sustainable Development, the European Partners for the Environment (EPE) and the European Commission for Enterprises to promote eco-efficiency Europe-wide. Details on its objectives, action areas and progress can be found on the EPE site by selecting "Resources" then "Most Recent Objectives".
*www.epe.be/programmes/eeei/index.html*

**UNEP/SETAC Life-Cycle Initiative**
This initiative's mission is to develop and disseminate practical tools for evaluating the opportunities, risks and trade-offs associated with products and services over their entire life-cycle to achieve sustainable development. The programs aim at putting life-cycle thinking into practice and at improving the supporting tools through better data and indicators.
*www.uneptie.org/pc/sustain/lcinitiative/home.htm*

**The World Energy Efficiency Association**

Non-profit organization composed of developed and developing country institutions and individuals charged with increasing energy efficiency worldwide, formed in 1993.
*www.weea.org/Start.htm*

## INFORMATION AND LEARNING

**ZERI Foundation**

The ZERI Foundation is a Swiss non-profit organization aiming to find solutions to issues such as zero-emissions processes in industry, and programs and material for schools, universities, companies and public authorities' programs.
*www.zeri.org*

**Zero Waste America**

Internet-based environmental research organization specializing in the field of Zero Waste. Provides information on associated legislative, legal, technical, environmental, health and consumer issues.
*www.zerowasteamerica.org/Index.htm*

# 5.0 Publications

## GENERAL SUSTAINABLE DEVELOPMENT

**The Business Case for Sustainable Development: Making a Difference Toward the Johannesburg Summit 2002 and Beyond**
*www.wbcsd.org*
The first in a series of three WBCSD reports for the World Summit on Sustainable Development in August 2002, this document restates the business case for sustainable development. It is a forward-looking statement that identifies building blocks toward a sustainable society.

**Sustainability Through the Market: 7 Keys to Success, 2002**
*www.wbcsd.org*
This report outlines how sustainability can be achieved using market forces. The seven keys are: innovate; practice eco-efficiency; move from stakeholder dialogues to partnerships for progress; provide and inform consumer choice; improve market framework conditions; establish the worth of earth; make the market work for everyone. The report is illustrated with 30 case histories.

**Tomorrow's Markets: Global Trends and Their Implications for Business, 2002**
*www.wbcsd.org*
Backed with facts and figures, this report outlines 19 key economic, environmental and social trends that will shape the future business agenda and market scenarios. Each topic is presented in a succinct, lively format that can be easily adapted for business use.

**Walking the Talk – The Business Case for Sustainable Development, 2002**
*Chad Holliday, Stephan Schmidheiny and Philip Watts, Greenleaf Publishing, 2002*
In this ground-breaking book, Stephan Schmidheiny – author of the hugely influential *Changing Course* – has joined with fellow prime movers in the World Business Council for Sustainable Development, Chad Holliday of DuPont and Sir Philip Watts KCMG, formerly of Shell, to spell out the business case for addressing sustainable development as a key strategic issue.

## ECO-EFFICIENCY

**Eco-Efficiency: The Business Link to SD**

*MIT Press, October 1997*

Livio De Simone from 3M and Frank Popoff from Dow Chemicals, two leading business figures, spell out the principles of eco-efficiency and present case studies of a number of international companies that are putting these principles into practice. The authors also discuss the value of partnerships across businesses and associations, communities, regulators and NGOs.

**Environmental Performance and Shareholder Value**

*WBCSD, 1997*

Geared toward managers, financial analysts and equity investors, this report argues that analyses can be improved by factoring in environmental elements. It uses 15 case studies to illustrate how companies are using eco-efficiency to bridge the gap between ecological and economic efficiency, differentiating themselves from competitors and delivering more value to shareholders.

**By-Product Synergy: A Strategy for Sustainable Development**

*WBCSD, 1997*

By-product synergy is the synergy among diverse industries, agriculture and communities resulting in profitable conversion of by-products and wastes to resources promoting sustainability. Based on the experiences of the members of BCSD-Gulf of Mexico, and case studies, this primer provides examples of how companies have increased their profitability, reduced pollution and natural resource use, and alleviated the adverse environmental impact of industrial development.

**Eco-Efficiency: Creating More Value with Less Impact**

*WBCSD, 1999*

This report is an essential compendium of information and a reference source for all those wishing to understand eco-efficiency. It highlights some of the ways in which eco-efficiency has been interpreted by companies in different sectors. The political dimension of eco-efficiency is also examined and recommendations are made on how governments can measure eco-efficiency and make it work for society by creating the right framework conditions.

**Measuring Eco-Efficiency: A Guide to Reporting Company Performance**

*WBCSD, 1999*

This practical guide offers companies advice on how to select, use and report on eco-efficiency indicators, thereby helping them measure their progress towards sustainability. 24 companies have already put its advice to the test in a special one-year pilot program, the results of which are documented within the report.

**Eco-Efficiency and Cleaner Production: Charting the Course to Sustainability**

A history of eco-efficiency by the International Institute for Sustainable Development.

# Developing the eco-efficiency learning module

Eco-efficiency has long been a cornerstone of the WBCSD's Work Program since its introduction in 1992. Over the years, more and more companies around the world have embraced the concept, embedding it in their management systems, as a way of finding new growth opportunities while minimizing their environmental impact. Our task has been to develop the concept and test its metrics through dedicated working groups, making it easier for companies to deliver on their targets and measure their performance, and for stakeholders to assess their progress.

In 2005, the WBCSD continues to promote eco-efficiency to business and its stakeholders as a cross-cutting theme in its Work Program. Its relevance spans from broad-based advocacy activities to more focused investigation of eco-efficient opportunities along specific themes or sectors. It is also a cornerstone of the WBCSD's regional network, helping to forge the link between environmental and economic performance.

In moving from awareness creation to implementation, eco-efficiency is also an important part of our Learning by Sharing program, which creates platforms, builds skills and develops tools to ensure WBCSD's messages reach the widest audience. To this end, we have developed this module to advocate and educate:

- the business drivers and value of adopting eco-efficiency
- the key strategies and tools for implementing eco-efficiency
- how to integrate eco-efficiency into business decision-making processes.

We would like to thank the many people who have contributed to this work:

- To the many managers within our member companies who have helped make eco-efficiency a reality, and who have contributed to earlier WBCSD work and case studies on eco-efficiency.
- The WBCSD's eco-efficiency champions from ERM, STMicroelectronics, KPMG, Fundácion Entorno and DeloitteTouche, with special thanks to Rene van Berkel, Western Australian Sustainable Industry Group (WASIG).
- Participants of the various workshops where this module was tested, including Brazil 2003, Argentina 2003, Paraguay 2003, Bolivia 2003, Montreux 2004, Paris 2005.
- The WBCSD's capacity building advisory board for support and direction.
- WBCSD contributors Marcel Engel and Danielle Carpenter.

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Design and production: Flag

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# About the WBCSD

The World Business Council for Sustainable Development (WBCSD) brings together some 180 international companies in a shared commitment to sustainable development through economic growth, ecological balance and social progress. Our members are drawn from more than 30 countries and 20 major industrial sectors. We also benefit from a global network of 50+ national and regional business councils and partner organizations.

Our mission is to provide business leadership as a catalyst for change toward sustainable development, and to support the business license to operate, innovate and grow in a world increasingly shaped by sustainable development issues.

Our objectives include:
Business Leadership – to be a leading business advocate on sustainable development;
Policy Development – to help develop policies that create framework conditions for the business contribution to sustainable development;
The Business Case – to develop and promote the business case for sustainable development;
Best Practice – to demonstrate the business contribution to sustainable development and share best practices among members;
Global Outreach – to contribute to a sustainable future for developing nations and nations in transition.

# About Five Winds International

Five Winds International is a management-consulting firm that helps organizations improve the economic, environmental and social performance – the sustainability – of their operations, products and services. Our strength is helping integrate environmental and social considerations into the core business activities of organizations. For private sector companies, these activities include strategy development, product design, operations, supply chain management, sales and marketing and capital investment. In the public sector, core business activities include policy and program development, performance measurement, service delivery, operations and procurement.

Five Winds' international team has expertise in business strategy, engineering and material science, industrial design, environmental science, resource economics, and government policy. The firm provides an international perspective through its offices in the United Sates, Germany and Canada. Our client base is primarily comprised of large multinational companies, but we also work with national, state and local governments, industry associations and multi-lateral organizations such as the UNEP and the OECD.

For information on out service offerings please visit out website www.fivewinds.com or contact Kevin Brady at 1.613.733.6629 or k.brady@fivewinds.com