Design for Environment

Definition

Design for environment (DfE) entails the integration of environmental considerations into the product design and development process. Companies use DfE tools and techniques to improve the environmental performance of products while reducing costs, improving competitiveness, and stimulating innovation. Successful DfE practices in product design and development balance environmental considerations with cost, performance, safety, functionality and quality criteria.

How is it Used?

Business application of design for environment typically involves three main elements:
• an understanding of product impacts and aspects;
• application of specific product design strategies; and,
• integration of tools and techniques within the product development process.

First, companies must develop an understanding of the environmental impacts and aspects of a product over its life cycle (i.e., from raw materials extraction, through production, distribution, use and end of life). In order to gain this understanding, life cycle assessment tools are often used.

Second, this understanding is applied through specific design strategies or guidelines to improve the product’s environmental performance (e.g., reduce material use, reduce energy consumption, reduce number of parts). Companies select specific design strategies based on:
• the product’s main environmental impacts;
• technical feasibility;
• cost; and,
• ability to meet other criteria (performance, safety, etc.).

Figure 1 illustrates seven core DfE strategies for product improvement.  

1 The term Design for Environment is used for clarity in this document. Terms such as Eco-Design, Green Design and Environmentally Conscious Design are also used throughout industry. The term Sustainable Design is also used by some companies, but frequently avoids addressing the social component of sustainability.
2 National Research Council Canada. Design for Environment Guide. www.nrc.ca/dfe. The seven core strategies are supported by 33 separate sub-strategies.
Finally, companies applying DfE often use specific tools such as checklists, performance indicators, goals and gates within the product development process. These tools ensure that environmental considerations are applied throughout the design and development of the company’s products. Some companies integrate these tools with their quality management systems (e.g., ISO 9001) or their environmental management systems (ISO 14001). This ensures consistent application of DfE and continuous improvement of environmental performance throughout the company’s products.

Who Uses It?

**Industry** — Design for environment is a tool used within the industrial design, product design and development functions of many manufacturing companies. Companies leading the way in the application of DfE are prevalent in the following sectors: automotive, furniture, consumer products, transportation, building materials, electronics and packaging. Companies use DfE as a means to address and implement sustainability, eco-efficiency, pollution prevention, product stewardship and cleaner production within the core business practice of product design and development.

**Government** — Government is driving the industry adoption of DfE through:
- Legislation and regulation: Product take-back and restricted substances legislation (particularly in the automotive, electrical and electronics sectors) is driving companies to design their products for ease of disassembly and recycling and free of hazardous substances and materials.³

• Assistance programs: Governments, including those in Canada, the European Union, the United States, Australia and Japan provide technical and financial assistance to companies for DfE projects and implementation. These national and regional programs are primarily voluntary, providing either direct assistance or via partners or third party consultants.
• Green procurement: Some companies have implemented DfE programs enabling them to develop products to meet specific green procurement requirements of government purchasers.

**Business Case**

Design for environment benefits for a company’s internal operations include:
• stimulating innovation within design and development staff;
• cost savings through:
  ? reduced raw material use;
  ? lower energy required for production;
  ? reduced waste and waste management costs;
  ? more efficient assembly and production processes;
  ? reduced permitting and material handling costs.
• improved health and safety through:
  ? reduction or elimination of toxic substances;
  ? reduction or elimination of harmful emissions;
  ? reduced need for pollution prevention equipment.
• improved worker motivation, satisfaction and morale; and,
• reduced risk and liability.

Companies may also benefit from:
• improved brand image;
• the establishment of new markets opportunities;
• improved ability to meet product standards and regulations;
• the acquisition of new customers and market share; and,
• reduced product risk and liability.

SC Johnson-Embracing Design for Environment

Product Innovation; The Green Advantage. An Introduction to DfE for Australian Business; Environment Australia, Department of the Environment and Heritage, Commonwealth of Australia; April 2001; Edited by PenUltimate

SC Johnson operates in 60 countries manufacturing domestic products, such as furniture polishes, air fresheners, glass and surface cleaners, insecticides, insect repellents and shaving gels. The company has an Australian manufacturing site making products, such as Windex, Toilet Duck and Glade Air Fresheners. The concept of DfE is actively pursued and rewarded across SC Johnson operations.

Where possible, SC Johnson uses recycled materials for packaging. Over five years, the company reduced the use of virgin packaging components by 26.8 per cent from 1990 levels. Aerosol packaging contains at least 25 per cent recycled steel and is itself recyclable, and shipping containers have a 95 per cent recycled content. The company also researches environmental data on raw materials to select ingredients with lower environmental impacts.

SC Johnson now makes only two types of bottles and spray triggers. This simplified production line reduces energy consumption, a significant cost benefit. Manufacturing processes are regularly assessed to reduce air emissions, waste emissions, wastewater, energy and fuel usage; the company’s goal is to reduce waste output by 50 per cent each year. Air water and solid waste disposals in operations have been roughly halved over five years, and before conventional waste management practices are employed all recycling opportunities are explored.

SC Johnson evaluates product ingredients against current scientific research, identifying any ingredients for removal from products. All company products and processes exceed legislative requirements for environmental performance.

SC Johnson uses independent audits, ongoing internal evaluations, and management and employee training programs to achieve continuous environmental improvement. Employees attend regular environmental training sessions, and an induction program trains new staff on SC Johnson’s environmental programs. The company’s global environmental management program and high level of environmental performance are improved by regular reviews of relevant scientific information and existing and impending environmental legislation. Global environmental performance is tracked annually according to internal environmental targets.
Trends and Future Importance

Design for environment practices will become more common in industry in the coming years. Several key issues are driving this growth:

• increasing demand for product innovation and differentiation;
• brand and company differentiation to maintain competitiveness;
• increasing costs and scarcity of raw materials;
• increasing cost of energy;
• increased consumer awareness around environmental and climate change issues that may translate into changes in purchasing requirements and behavior;
• renewed green purchasing initiatives within the European and North American governments that may create a demand for products with improved environmental performance, innovation, environmental labeling and product certification;
• increasing demands from supply-chain and business customers stimulating more open and transparent communication and business relationships;
• legislation and regulations that influence the materials, substances, and chemicals (used in products and production); and,
• the growing sophistication and activism of consumer organizations and environmental groups that may result in specific materials, substances and chemicals being targeted (e.g., PVC) as detrimental to human and environmental health.

Related Legislation and Regulations

Although there is currently no legislation or regulation requiring the application of DfE within companies, DfE can be used to achieve compliance and even exceed the requirements of many types of regulations (see above). In general, it is anticipated that there will be an increasing focus on the early design stages of products and services to achieve more sustainable forms of production and consumption.

The European Commission has drafted the *End-Use-Equipment Directive* that would require manufacturers (of products and equipment that uses energy during the use phase) to report on how they are integrating environmental considerations into their product design processes and environmental management systems.\(^4\) Extended producer responsibility legislation, such as the *End-of-Life Vehicle Directive* in the EU and product specific landfill bans and recovery regulations here in North America (e.g., covering mercury thermometers) are also driving DfE activities.

In addition, the International Organization for Standardization (ISO) will soon publish a Technical Report entitled ISO 14062 *Environmental Management: Integrating Environmental Aspects into Product Design and Development*. ISO 14062 has been cited within several policy documents as a guide for companies seeking to integrate DfE into their activities.

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Linkages to Other tools

Environmental Management Systems (EMS) — DfE implements the continuous improvement of product environmental performance.

Life Cycle Assessment (LCA) — LCA is frequently used as a tool within a company’s DfE program or activities to identify the main environmental impacts and aspects of its products.

Pollution Prevention — DfE can be used as a means of minimizing or eliminating materials of concern, hazardous substances and toxic chemicals from products and production processes.

Eco-efficiency — DfE can be used as a means of applying the core elements of eco-efficiency to the design and development of products.

Environmental Supply Chain Management — Considering the environmental impacts and aspects of components, materials or substances provided by suppliers is an integral component of DfE. Therefore, it affects supplier relationships and their management by the company.

Green Procurement — Similar to supply chain management, DfE influences the types and nature of components, materials or substances purchased by a company. Product designers and developers often work closely with purchasing departments to ensure environmental performance criteria are met.

Life Cycle Management — DfE is a tool to assist a company in optimizing the environmental performance of its products and contributing to the effective management of products throughout their life cycle.

Key References


Existing Case Study Sources

National Research Council, Industrial Research Assistance Program, DfE Guide
EPA Design for Environment Partnership Projects
Journal of Sustainable Product Design (Kluwer)
Design + Environment (Greenleaf)
Design Council Case Studies
Global Responsibility Case Studies
Interface
Electrolux
Henkel

Possible Sources of Case Studies

Carrier Corporation
Teknion Corporation
APMA/Magna
Siemens Automotive Systems
SMED Furniture
Hewlett Packard
Black & Decker
Pollution Prevention

Definition

Pollution prevention (P2) can be defined as the use of processes, practices, materials, products or energy that avoids or minimizes the creation of pollutants and waste, and reduces overall risk to human health or the environment. Simply put, pollution prevention focuses on avoiding the creation of pollutants, rather than trying to manage them after they have been created.

How is it Used?

Industrial manufacturers identify and implement pollution prevention strategies in the product and production planning stage. Industrial process modifications are made to reduce pollution by improving traditional manufacturing techniques in order to use fewer resources and produce less waste. Manufacturers can also implement product reformulation strategies, which include technical improvements to product designs, in order to reduce their environmental impacts. Industrial applications are taken by companies going beyond current government standards for environmental protection and may include such steps as eliminating components and materials considered to be toxic. New or “clean” technologies are employed to reduce or eliminate the release of harmful chemicals to the environment.

Effective pollution prevention requires taking a different approach to the design and operation of facilities, such as mines, farms, manufacturing plants, refineries, transportation systems, parks, and any other facility that can potentially create waste and pollution. The implementation of pollution prevention may vary from sector to sector, but generally, techniques and practices focus on these areas:

- material and feedstock substitution;
- product design/product reformulation;
- process changes;
- reuse and recycling on-site;
- training;
- purchasing policies and techniques;
- equipment modifications; and,
- operating efficiencies/clean production.

Who Uses It?

Pollution prevention is a useful framework for organizations and individuals and is an effective means of protecting the environment, eliminating costly waste, and promoting sustainable development.

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Industry — The application of pollution prevention is evident in large and small industrial manufacturing operations. The tools of pollution prevention include assessments, audits and plans. These tools can be applied during waste and toxics minimization planning, preventive maintenance, and operational process improvements, such as production scheduling and planning.

Government — Pollution prevention is the cornerstone of the *Canadian Environmental Protection Act, 1999* (CEPA 1999). Environment Canada has led Canadian government efforts through implementation of the Federal Pollution Prevention Strategy. Federal departments and agencies participate in interdepartmental groups for developing common tools, coordinating activities and sharing information on pollution prevention. See Table 1 for federal P2 initiatives.⁶

Table 1: Federal Progress on Pollution Prevention

<table>
<thead>
<tr>
<th>Actions</th>
<th>Status</th>
<th>Examples</th>
</tr>
</thead>
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| Review legislation, regulations and policy for opportunities to harmonize approaches to pollution prevention. | Ongoing | • CEPA 1999  
• CCME Canada-wide Standards Memorandums of Understanding between Environment Canada and Provincial Departments of Environment.  
• Federal Environmental Emergencies-Spill Planning Regulation |
| Develop practical tools, such as guidelines and codes of practice, to enable people to implement pollution prevention at an operational level. | Ongoing | • Federal Pollution Prevention Planning Handbook  
• CEPA 1999 Guidelines for Implementing the Pollution Prevention Provisions of CEPA 1999  
• Mandatory P2 Planning under the City of Toronto Sewer Use Bylaw  
• Energy Solutions Centre |
| Educate the public and train relevant groups in the technical aspects of pollution prevention. | Ongoing | • CCME Pollution Prevention Awards  
• Canadian Pollution Prevention Roundtable  
• Canadian Pollution Prevention Information Clearinghouse  
• Enviroclub (Quebec region)  
• Climate Change Action Fund Program  
• Pollution Prevention Planning Tutorial. |

Business Case

Pollution prevention is applicable to all sectors of the industrial manufacturing economy as well as the service industry, financial sector and government. P2 achieves several benefits:\(^7\)
- minimizes or avoids the creation of pollutants;
- accelerates the reduction and/or elimination of pollutants;
- minimizes health risks;
- uses energy, materials and resources more efficiently;
- minimizes the need for costly enforcement from government;
- avoids burdensome administration and offers more flexibility to company than regulated approach;
- limits future liability; and,
- avoids costly cleanups.

Pollution prevention during the manufacturing process is an opportunity to save costs associated with:\(^8\)
- disposal;
- raw materials/consumables;
- ventilation equipment;
- maintenance (ducts, motors, balancing);
- operations;
- pollution prevention equipment;
- occupational health and safety (protective equipment, training); and,
- regulatory compliance (approval from government).

\(^7\) The Canadian Council of Ministers of the Environment, 1996.
\(^8\) NRC; Sustainable Development. [www.nrc.ca/dfe/ehome/overview/sd/sd.html](http://www.nrc.ca/dfe/ehome/overview/sd/sd.html).
**3M Pollution Prevention Pays**

From 1975 to 2001, 3M's Pollution Prevention Pays (3P) program has prevented 821,344 tons of pollutants and saved $857 million. The 3P program helps prevent pollution at the source rather than removing it after it has been created.

3P is a key element of 3M’s environmental strategy and moving the company towards sustainability. 3P has shown that a prevention approach is more environmentally effective, technically sound and economical than conventional pollution controls. Natural resources, energy and money are needed to build conventional pollution controls, and more resources are consumed operating them. Conventional control only manages the problem; it does not eliminate it. 3P seeks to eliminate pollution at the source through:

- product reformulation;
- process modification;
- equipment redesign; and,
- recycling and reuse of waste.

The 3P program depends directly on the voluntary participation of 3M employees. Innovative projects are recognized with 3P Awards. A 3P Coordinating Committee representing 3M's engineering, manufacturing and laboratory organizations — and the environmental, health and safety group — administers the program. 3M employees worldwide have initiated more than 4,820 3P projects. Projects must meet these criteria to receive formal recognition:

- eliminate or reduce a pollutant;
- benefit the environment through reduced energy use or more efficient use of manufacturing materials and resources; and/or,
- save money through avoidance or deferral of pollution control equipment costs, reduced operating and materials expenses, or increased sales of an existing or new product.

A special award also recognizes projects that demonstrate technical innovation.

Source: www.3m.com/about3m/sustainability/policies_ehs_tradition_3p.jhtml.

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**Trends and Future Importance**

The Government of Canada, industry, environmental NGO’s and academia, are driving the practice of pollution prevention through regulatory, non-regulatory and economic instruments. These include advancing legislation and regulations, implementing partnership programs, developing industry guidelines and standards, establishing national material and
substance lists, improving the accessibility of information, and developing pollution prevention tools.

The Canadian Council of Ministers of the Environment (CCME) presents annual Pollution Prevention Awards. The awards, established in 1997, recognize small, medium and large companies, as well as associations and organizations that show leadership in pollution prevention.

**Related Legislation and Regulations**

The *Canadian Environmental Protection Act, 1999* (CEPA 1999) was officially proclaimed on March 31, 2000. Pollution prevention is the cornerstone of CEPA 1999, which provides the Minister of the Environment with new powers and tools to protect the environment and human health and to contribute to sustainable development through pollution prevention.

CEPA Environmental Registry, mandated under Section 12 of CEPA 1999, is a source of public information relating to activities under the Act. CEPA Environmental Registry at www.ec.gc.ca/CEPARegistry.

To view the pollution prevention capabilities of some of Canada’s best technology and service firms, visit Canadian Environmental Solutions (CES) at http://prods.businesscanada.ic.gc.ca/Ces_Web/_index_.cfm.


Federal-Provincial Territorial Agreements
- Enforcement and Emergency
- Environmental Assessment
- Fisheries Act
- Compliance and Enforcement Policy
- Compliance and Enforcement Policy
- Canada Gazette
- Justice Canada
- Transportation of Dangerous Goods
- Canadian Environmental Assessment Act and Regulations
- Department of the Environment Act
- Pollution Prevention and the Canadian Environmental Protection Act
Linkages to Other Tools

**Environmental Management Systems (EMS)** — Pollution prevention activities can often be organized within a formal EMS.

**Design for Environment (DfE)** — DfE can complement pollution prevention by focusing on “designing out” materials, substances or processes that produce pollution or generate waste.

Key References

The Canadian Centre for Pollution Prevention — www.c2p2online.com.

Existing Case Studies

Canadian Pollution Prevention Information Clearinghouse Database
SCJohnson
TransAlta
Suncor

Suggested Industry Case Studies

See Canadian Centre for Pollution Prevention for case examples
Siemens
Kuntz Electroplating
Dow
Life Cycle Management

Definition

Life cycle management (LCM) is a flexible integrated framework of concepts, techniques and procedures used to address environmental, economic, technological and social aspects of products and organizations in order to achieve continuous environmental improvement from a life cycle perspective.  

How is it Used?

Life cycle management is an approach that is closely tied to the concept of the product life cycle. It encompasses a host of tools based on the life cycle concept: life cycle inventory, life cycle impact assessment, and life cycle costing, among others. Life cycle management may also be used more broadly to cover a wide range of environmental management tools, such as extended producer responsibility, design for environment and supply chain management. It may also extend to communication and outreach efforts to promote the environmental performance advantages of a product or service. Life cycle management provides a convenient framework for these tools, since each can be classified by the life cycle stages with which it deals.

Who Uses It?

Industry — Corporations are taking a full life cycle approach to products and services. One major application is in product development; another key role is in procurement practice and management of supply chains, including material specifications and material restrictions.

Government — Government departments in many countries are promoting life cycle management. In particular European countries promote the concept of an integrated product policy, similar in many respects to LCM. IPP may be the governmental aspiration of LCM.

Academia — Academic institutions are studying the use of life cycle management to deal with products, services and materials; universities such as Carnegie Mellon University and Royal Melbourne Institute of Technology are working in the area of life cycle assessment. SETAC, the Society for Environment Toxicology and Chemistry, has a working group on LCM in Europe. Other related research activities include work on product oriented environmental management systems (POEMS) at the University of Delft in the Netherlands, and environmental product responsibility activities at Lund University, Sweden.

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Business Case

Life cycle management can be used as an overarching environmental management approach that looks at all life cycle stages. LCM can be an effective method of determining the most environmentally and cost effective methods of doing business. This might be accomplished through a life cycle assessment that includes life cycle costing. The greatest sources of environmental impact and cost are exposed and changes can then be made. Evaluations made from a life cycle perspective also have the advantage of being able to identify possible tradeoffs (e.g., a change in production may reduce air emissions but increase water emissions).

Taking a life cycle approach may allow an organization to take advantage of new business opportunities. These may exist in several life cycle stages:

- reduce material use to lessen the impact at the resource extraction stage;
- work with suppliers to optimize transportation of supplies (minimizing environmental impact of transportation);
- educate consumers on the proper operation of products to limit environmental effects in the use phase;
- take back products to ensure they are properly disposed of at their end-of-life;
- link communication and brand image with economical and environmental considerations; and,
- allow better and fuller understanding of a product’s impacts and business risks for decision makers.

All of these measures can lead to cost savings (less material, optimized transportation) or increased revenue (better consumer relations, recycling revenues).
Ashland Inc.

For Ashland’s specialty chemical and distribution businesses, its customers’ need to manage life cycle impacts of chemicals is a business opportunity. Ashland collaborates with its customers to improve business performance at many points in the supply chain, from R&D through manufacturing, distribution, and waste disposal.

Within research and development, efforts have included reformulating products that will be used in the production of consumer products in order to eliminate the use of volatile organic compounds (VOCs) and the regulatory burden imposed by the US Clean Air Act.

Technology development in the manufacturing of foundry resins has allowed customers, such as BMW and General Motors, to substitute aluminum for traditional steel in the manufacturing of vehicle engines and transmissions. This, in turn, has improved vehicle fuel efficiency and recycling at the end of product use.

Ashland’s electronic chemicals businesses have developed product handling techniques that have improved customers’ use of certain products (e.g., isopropyl alcohol, through recycling and methods of application that improve production efficiency, reducing product and waste management costs). Often Ashland employees are placed on customer sites to manage chemical deployment from purchase through production to disposal.

The environmental services business provides site-specific waste management solutions that reduce the burden of waste management by the customer. Upon transfer of waste, Ashland indemnifies customers against legal liability.

By managing their chemicals and associated liabilities, Ashland helps its customers focus on their primary areas of business.

Trends and Future Importance

Life cycle management is continually gaining acceptance as a holistic approach to environmental management. One new area that is being considered is the use of LCA methods for measurement of greenhouse gases. As well, under the UNEP/SETAC Life Cycle Initiative an LCM program has been initiated. Both industry and governmental stakeholders, as well as NGOs, have expressed great interest in the further development of the concept. A user need survey in the definition study of this effort revealed an overwhelming level of support for the approach.

Related Legislation and Regulations

There are no regulations directly associated with life cycle management. A life cycle management approach may be used to deal with many related types of legislation, such as product take-back legislation, banned substances and emissions and waste limitations. Since LCM is a rather broad framework, it is inclusive of different regulatory elements.

Linkages to Other Tools

Life Cycle Assessment (LCA) — LCA is a life cycle tool that may be used as part of a life cycle management effort.

Environmental Supply Chain Management — This may be included in a life cycle management effort as a way of addressing the early life cycle stages (i.e., materials procurement).

Extended Producer Responsibility (EPR) — EPR may be a part of a life cycle management effort dealing with the final life cycle stages (i.e., product disposal or reuse).

Design for Environment (DfE) — The stages of DfE are largely the same as the life cycle stages; design for environment may form part of a life cycle management effort.

Integrated Product Policy (IPP) — IPP, which is similar to LCM in many respects is the approach used in the European Union.

Key References


Existing Case Study Sources

3M’s Life Cycle Management

Possible Case Study Sources

Unilever
UTC
Nokia
Life Cycle Assessment

Definition

Life cycle assessment (LCA) 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. LCA has been standardized by the International Organization for Standardization (ISO) and forms the conceptual basis for a number of management approaches that consider a product across its life cycle, covering resource acquisition, product manufacturing, use and end of life.

How is it Used?

Typically, LCA is used to evaluate the environmental implications of materials and products, although services have also been studied using this tool. According to the ISO Standard on LCA, it can assist in:

- identifying opportunities to improve the environmental aspects of products at various points in their life cycle;
- decision making in industry, governmental or non-governmental organizations (e.g., strategic planning, priority setting, product or process design or redesign);
- selection of relevant indicators of environmental performance, including measurement techniques; and
- marketing (e.g., an environmental claim, eco-labelling scheme or environmental product declaration).

Various software tools and databases are available that enable the user to track materials flows, energy flows and pollution from any industrial system. Typically, the databases provide generic information on materials, energy supply options, transportation options and end of life management. A product manufacturer can enter data and put together a comprehensive set of information on the entire product system. Then various types of analyses can be conducted to determine the implications of changes to the systems (e.g., what if we used a different material, energy supply option or manufacturing process) on various environmental issues. In some cases, short screening level studies are done that can quickly help the user identify potential “hot spots” in the product system. In other examples, a more significant study must be conducted, for example to develop an environmental product declaration.

Who Uses It?

Industry — Many large companies have included LCA in their environmental management programs. Companies in Canada that have utilized LCA include Interface, Canfor, Suncor, Alcan, Magna International, Consumer Gas, Siemens North American Motor Operations, and many others. LCA studies are also commonly conducted by industry associations and
research organizations (e.g., Canadian Wood Council, International Copper Association, International Lead and Zinc Research Organization, International Iron and Steel Institute, International Aluminum Institute and the Nickel Development Institute).

**Government** — Government departments around the world have been actively promoting LCA (see References). For governments, LCA is useful in developing more effective environmental policies related to materials and products.

**Academia** — There is a great deal of LCA activity and research at several academic institutions, such as École Polytechnique de Montréal’s Interuniversity Reference Center for the Life Cycle Assessment (CIRAIG), University of Toronto, Queens University and the University of Calgary. Outside Canada, Carnegie Mellon University in Pittsburg, PA and Royal Melbourne Institute of Technology in Australia are leading institutions researching the application and methodology of LCA.

**Business Case**

LCA is a powerful tool that is capable of producing information that can be used in many applications. One of the most important characteristics of LCA is the ability to comprehensively examine all the stages that a product goes through. LCA can thus be used to expose environmental trade-offs (e.g., a change in production may reduce air emissions but increase water emissions).

While the method for conducting LCA follows a well-defined path, as laid out in the ISO 14040 standards, there is room for flexibility in applying the tool. In the scooping stage, the system boundaries can be defined to include only the life cycle stages that the proponents are interested in (e.g., only manufacturing and transportation to market). The study can be comprehensive or streamlined (as described in Trends and Future Importance below). As a result of this flexibility, many companies are finding that streamlined life cycle assessments aid in their strategic planning and design and development programs. The results may also be used externally to communicate with stakeholders.

LCA can be utilized to meet a wide variety of goals. It can be used to identify potential process or product improvements, or to test the effectiveness of proposed improvements. LCA may be used to compare the environmental performance of competing products, or to compare a new technology to an old one. It can also be used to produce informational labels, such as Type III labels as defined under ISO 14025.

The business value of LCA is in gaining a better understanding of environmental impacts associated with a company’s product or service and, therefore, making better decisions in terms of selection of materials, technologies, processes, transportation options, etc. Business value can also be gained when a company uses LCA to demonstrate the environmental benefits of its products or services to its customers and the marketplace in general.
Alcan

Alcan’s strategic use of LCA has two objectives: meeting customers’ needs, and taking full advantage of materials’ properties throughout its life cycle.

Alcan has been involved in many life cycle assessment initiatives:
• played a leading role in the life cycle inventory effort of the Automotive Materials Partnership, which brought together Ford, DaimlerChrysler and General Motors with aluminum, plastic and steel producers;
• in Europe, conducted LCAs on several products, including car body sheets and aluminum laminates;
• in its Kingston, Ontario, rolled products facility, a life cycle-type technology assessment led to the elimination of nitrogen and nitrogen oxide emissions from the furnace, raising productivity by 33 per cent; and,
• when the company redesigned its aluminum foil packaging and reduced the mass by 50 per cent, they used LCA to help quantify the benefits (reduction in cardboard use, more efficient use of retail shelf space and more economical transportation).

Alcan has used LCA to highlight the advantages of aluminum in terms of greenhouse gas (GHG) emissions. Alcan and Ford have become the first companies in North American to employ “closed-loop recycling” of aluminum autobody sheet. Under the joint project, Ford recovers aluminum process scrap from its Chicago stamping plant and returns it to Alcan for recycling directly back into autobody sheet (closed-loop recycling). Previously, the recovered aluminum was sold into the general scrap market in combination with other metals, thus diminishing both its quality and value and making it unsuitable for re-use in autobody applications. Recycling of aluminum only requires five per cent of the energy required to produce primary aluminum, and thus recycling produces 95 per cent less carbon dioxide than the use of primary aluminum.

Alcan has used life cycle data to identify improvement opportunities throughout its operations, to support the development of its strategic approach to the climate change issue, and to demonstrate the environmental value of its products to customers.

Source: Alcan’s Journey Toward Sustainability.
www.alcan.com/corporate/alcancom.nsf/graphics/reports/$file/csr_complete_e.pdf
Trends and Future Importance

Life cycle assessment and the broader concept of life cycle thinking, are continually gaining popularity as a holistic approach to environmental management. One new area that is being considered is the use of LCA for the measurement of greenhouse gases. When they were first conducted, LCA studies were frequently very time and resource intensive. In recent years, the method for conducting LCA has been refined, so that a streamlined LCA can produce the level of detail necessary with minimal input of time and resources. Large public databases are being developed and, in North America, a large-scale industry, government and academic partnership has been developed to create a publicly available database.

Another trend is the integration of LCA into research and development environmental management system implementation (as has been practiced at Lucent and IBM). Also, LCA has been used to support design for environment initiatives, in order to uncover tradeoffs and track improvement (in organizations such as Volvo, GM, Teknion and Interface).

Related Legislation and Regulations

Although there is no legislation or regulations that are directly associated with LCA, there are regulations related to life cycle stages that are not traditionally considered by industry, such as product take-back legislation. LCA can be used to support these and other types of legislation, including those on banned substances, and emissions and waste limitations.

Linkages to Other Tools

Life Cycle Management — A broader concept than LCA; considers all the life cycle stages as part of management, and may take into account criteria beyond environmental issues, such as cost and health and safety.

Design for Environment — LCA may be used to identify aspects of products that would most benefit from DfE, or to make decisions between materials.

Environmental Management Systems — LCA can play an important role in determining the aspects and impacts of products.

Product Stewardship — LCA allows an organization to identify impacts throughout the life cycle so that management plans can be developed.

Key References

École Polytechnique de Montréal’s Interuniversity Reference Center for the Life Cycle Assessment (CIRAIG).


**Global Engineering Documents**

ISO Society for Environmental Toxicology and Chemistry
European Environment Agency — Life Cycle Assessment
Environment Canada — Ecocycle
UNEP/SETAC Life Cycle Initiative
International Journal of Life Cycle Assessment
US EPA LCAccess
Environment Australia — Life Cycle Assessment
Cradle to Grave

**Existing Case Study Sources**

Unilever — LCA Case Studies
Center for Sustainable Systems — Research Highlights
Pembina Institute — LCVA of a Wind Turbine
LCA of Nickel

**Possible Sources of Case Studies**

Interface Flooring
Black & Decker
APMA/Magna
Nickel Development Institute
Canfor
Integrated Product Policy

Definition

Integrated product policy (IPP) is a government policy concept that seeks to minimize environmental degradation by addressing all phases of a product’s life cycle and taking action where it is most effective. The premise of IPP is that a variety of tools — such as economic instruments, Extended Producer Responsibility type programs, substance bans, voluntary agreements, environmental labelling and product design guidelines — can be used to address the system wide (life cycle) impacts of the many different products and processes that exist.¹⁰

Although elements of IPP are in wide use (e.g., labelling, green procurement, design for environment programs) there is very little integration with the exception of a few national efforts (e.g., Sweden, Netherlands and Denmark). In this sense, IPP is not one specific policy tool, but rather a unifying concept that seeks to optimize government decision making related to reducing the environmental impacts of products.

How is it Used?

IPP is an approach that is still under development, and the discussions are most advanced within the European Union. The European Commission stimulated discussion on IPP with the publication of a green paper in 2001. Integrated product policy as outlined in the green paper concentrates on three main principles:

1. Fixing the prices of products — Adjusting the price of products, in accordance with the polluter pays principle, to account for environmental costs.
2. Stimulating demand by informing consumer choice — Increasing consumer awareness of product environmental impacts, leading to increased demand for green products.
3. Stimulating supply through eco-design of products — Promoting the use of environmental design for product development and thereby increasing the supply of green products.

The green paper also indicates which tools might be used to support the various principles. These are summarized in Table 1.

Table 1: Tools for Applying Integrated Product Policy (IPP)

<table>
<thead>
<tr>
<th>Principle</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Getting the price right</td>
<td>Differential taxes (possibly based on environmental labels)</td>
</tr>
<tr>
<td></td>
<td>Extended producer responsibility</td>
</tr>
<tr>
<td>Stimulating demand</td>
<td>Environmental labelling programs (Type I labels)</td>
</tr>
<tr>
<td></td>
<td>Product declarations (Type III labels)</td>
</tr>
<tr>
<td></td>
<td>Environmental procurement policies in public organizations</td>
</tr>
<tr>
<td>Stimulating supply</td>
<td>Life cycle assessment (LCA)</td>
</tr>
<tr>
<td></td>
<td>Design for environment (DfE)</td>
</tr>
</tbody>
</table>

In addition to the tools outlined above, the green paper also highlights environmental management systems, research and environmental accounting as tools that can help promote IPP in general.

Who Uses It?

**Government** — It is intended that governments would implement the policies and some of the tools within IPP. In Canada, a Meeting on Product- and Supply-Chain Focused Policies and Tools (PSPT) for Sustainable Development was held in Ottawa, in February 2000. This was the first multi-stakeholder consultation held on this subject in Canada, and it resulted in guidance to government on product approaches, such as IPP. Current activity in Canada is, however, limited to isolated initiatives in the above-mentioned areas, such as procurement, labelling and design.

**Industry** — The broad scope of IPP means that companies can be affected in a variety of ways (e.g., manufacturers could be expected to integrate environmental considerations into their product development processes). A number of companies have undertaken comprehensive product focused environmental management activities that integrate, procurement, product design, and sales and marketing efforts.

Business Case

Integrated product policy is expected to consolidate several environmental tools and apply them in an efficient manner. Presumably government promotion and utilization of the suite of tools available under the IPP umbrella will lead to a reduction in the overall environmental burden of products on the environment. The effectiveness of IPP will depend on the cooperation of a number of actors, including finance ministries, product manufacturers, consumers and others.

In theory, IPP will reveal the true cost of products, including the environmental costs that are often hidden. Differential taxes (if imposed) would give an advantage to those products that
cause less environmental harm. Extended producer responsibility may cause companies to internalize the costs incurred by their products when they reach the end of their life. Environmental labels and product declarations can provide consumers with the information they need to choose products that are less environmentally damaging. It is sometimes difficult for these products to reach mainstream consumers if they are initially introduced in a niche market, but the demand can be significantly stimulated by environmental purchasing policies in public institutions. Life cycle assessment (LCA) and Design for environment (DfE) are tools that companies can use in their product development process. In addition to improved product performance, there are benefits that the companies can realize through the use of these tools (see profiles on LCA and DfE).

Under an IPP approach, the tools would be applied simultaneously, thus benefiting from synergies between them (e.g., a product made using DfE will have reduced impact, and a product declaration will communicate this to the public).

From an industry perspective IPP, while possibly beneficial, is worrisome. There is very little track record of integrated environmental policy approaches and how this would be coordinated and implemented by government is uncertain.
European Union Proposed Directive on Establishing a Framework for Eco-design of End Use Equipment (EUE)

There are three proposed Directives in the EU targeted at electrical and electronic equipment. The first is the Directive on Waste Electrical and Electronic Equipment (WEEE). The aim of this directive is to make producers of this type of equipment responsible for its end-of-life management. The second directive would restrict the use of certain hazardous substances in electrical and electronic equipment. The restrictions (on lead, mercury, brominated flame-retardants, cadmium and hexavalent chromium) would “contribute to the environmentally sound recovery and disposal of WEEE.” Both of these proposed directives are Environmental Producer Responsibility type policies, in that they deal primarily with the management of EEE waste and the harmonization of legislation regarding the reduction of hazardous substances.

A third directive has now been proposed that aims to reduce the overall environmental impact of EEE throughout their lifecycle and to ensure free movement of compliant equipment within the European internal market. The elements of this new directive are elaborated in a working paper for a proposed draft Directive on Establishing a Framework for Eco-design of End Use Equipment (EUE). This initiative combines into one directive two earlier initiatives — the EEE (impact on the environment of electrical and electronic equipment) and the EER (energy efficiency requirements). The working document established a single framework for setting eco-design requirements, while providing the option for setting more detailed requirements.

The EUE can be considered indicative of an IPP approach. It recommends a very broad initiative to develop specific requirements for particular product categories with "end use equipment" (any product that uses electricity, fossil fuels or renewable energy to work as intended); because of this breadth, the directive could have substantial impact on an extremely wide range of industrial and consumer product manufacturers. It could also allow EU member countries to fulfill Kyoto requirements by directly dealing with issues of energy efficiency and consumption.

Specific requirements for manufacturers could include:
• performing assessment of the environmental aspects of the product;
• determining the ecological profile of the product;
• measuring inputs and outputs in physical quantities; and,
• focussing on specific issues such as materials, mass, volume, energy, emissions etc. (termed "eco-design parameters").

As well, environmental management system requirements may include:
• product performance objectives and indicators to be in place, as well as management responsibilities;
• verification procedures, document control; and,
• a plan-do-check-act system in place for managing eco-design/design for environment.
Trends and Future Importance

It was expected that there would be a European Commission white paper on IPP and that this would lead to a specific directive(s). However, it now appears that there will instead be further work on the specific tools that make up IPP. A study has been completed on environmental product declarations. Currently, a study is being conducted on the external environmental effects related to the life cycle of products and services. The European Commission has also commissioned the construction of a trial database on the environmental aspects of products and services.

Related Legislation and Regulations

European Directive on End of Life Vehicles
European Directives on Waste Electrical and Electronic Equipment (WEEE), Restricted and Hazardous Substances (RoHS) and Electronic and Electrical Equipment (EEE)
European Integrated Pollution Prevention and Control (IPPC) Directive

Linkages to Other Tools

Life Cycle Management (LCM) — Like LCM, IPP provides a framework for a variety of tools and uses a life cycle approach.

Key References

Integrated Product Policy
Green Paper on Integrated Product Policy
Eco-innovation: Helped or hindered by Integrated Product Policy
Environmentally friendly end use equipment – proposal for an EuE Directive
http://europa.eu.int/comm/enterprise/electr_equipment/eee/

Existing Case Study Sources

BSD IPP Case Studies
European Eco-label and IPP
Ecological, social and economic aspects of Integrated Product Policy: Developing two instruments
Environmental Product Declarations and IPP
IPP in Norway

Possible Sources of Case Studies

EU Ecolabel
The Netherlands National Environmental Policy Plan
Differential Taxes in Sweden
EuE Directives
IPPC Directive
Industrial Ecology

Definition

Operating from the premise that in natural systems there is no waste, industrial ecology (IE) is a theoretical framework to examine environmental and efficiency flaws in existing industrial operations, to guide the development of new systems. One of the goals of IE is to model industrial systems on natural ecosystems, in which waste products from one process are inputs for another. An industrial system of this type will reduce environmental risk, because the underlying causes will have been minimized or eliminated at the design stage.

The field of IE is maturing quickly and now encompasses studies of material and energy flows at the local, regional and national level, product design and life cycle analysis, and relationships between industries and sectors at industrial park, community and regional levels. There are also studies of strategies for decarbonizing economies and using information instead of materials. The emphasis is now on the efficient and the effective use of resources to satisfy our needs.

Industrial ecology asks us to “understand how the industrial system works, how it is regulated, and its interaction with the biosphere; then, on the basis of what we know about ecosystems, to determine how it could be restructured to make it compatible with the way natural ecosystems function.” Industrial ecology encompasses a variety of related areas of research and practice, including:

- material and energy flow studies ("industrial metabolism");
- dematerialization;
- technological change and the environment;
- life cycle assessment, design and planning;
- design for the environment;
- extended producer responsibility (product stewardship);
- eco-industrial parks;
- product-oriented environmental policy; and,
- eco-efficiency.

The six principal elements of industrial ecology are as follows:

1. Industrial Ecosystems — Fostering cooperation among various industries whereby the waste of one production process becomes the feedstock for another.

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13 International Society for Industrial Ecology. www.yale.edu/is4ie.
2. Balancing industrial input and output to the constraints of natural systems — Identifying ways that industry can safely interface with nature, in terms of location, intensity, and timing, and developing indicators for real-time monitoring.

3. Dematerialization of industrial output — Striving to decrease materials and energy intensity in industrial production.

4. Improving the efficiency of industrial processes — Re-designing production processes and patterns for maximum conservation of resources.

5. Development of renewable energy supplies for industrial production — Creating a worldwide energy system that functions as an integral part of industrial eco-systems.

6. Adoption of new national and international economic development policies — Integrating economic and environmental accounting in policy options.

In summary, industrial ecology is a system’s approach to the analysis of the flows of materials and energy considering: the life cycle of products; the design of buildings, infrastructure and industrial parks; and the reuse, recovery and recycling of resources in a manner which is cleaner and more efficient. The approach recognizes the relationship of materials, products and infrastructure to ecological functions and services provided by the natural environment.15

**How is it Used?**

Industrial ecology may be approached in three ways. The first is material specific; that is, it selects a particular material or group of materials and analyzes the ways in which it flows through the industrial ecosystem. Such an analysis in manufacturing operations is generally made while products are in their manufacturing cycle, and any modifications to materials or processes tend to be costly and difficult.

The second type of industrial ecology analysis is one which is product-specific; that is, it selects a particular product and analyzes the ways in which its different component material flows may be modified or redirected in order to optimize product-environment interaction. Such an analysis is particularly appropriate at the initial design stage of a product, when decisions on alternative materials or processes can often be made at a stage preceding the investment of large amounts of capital for equipment or process development, an action that often locks in a particular material or process for the long term.

The third approach is location specific; that is, it selects a specific location where an eco-industrial park is developed from existing or new industries. Industries are coordinated to allow the efficient use of energy and material flows. For example, by-products of one facility may be used by another, or the park might share a common heat and power source.

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Who Uses It?

**Industry** — Eco-industrial parks account for the bulk of effort towards implementing industrial ecology in the business sector. Eco-industrial parks are designed to allow firms to share infrastructure as a strategy for enhancing production and minimizing costs. The distinguishing feature of eco-industrial parks is their use of ecological design to foster collaboration among firms in managing environmental and energy issues. In an eco-industrial park setting, company production patterns work together to follow the principles of natural systems through cycling of resources. Eco-industrial parks offer firms the opportunity to cooperatively enhance both economic and environmental performance through increased efficiency, waste minimization, innovation and technology development, access to new markets, strategic planning, and attraction of financing and investment. With the development of more eco-industrial parks, some the biggest users of IE are economic, community and industrial developers.

**Government** — Governments are supportive of the growth of eco-industrial parks as a means of supporting business success and environmental protection. At all levels of policy-making, procurement policies, tax code changes, and infrastructure investments can benefit from industrial ecology insights.

**Academic** — Academic institutions have conducted industrial ecology research on a number of specific materials and economic sectors. Future efforts are likely to address industry perspectives across sectors and at several levels. Industrial ecology research has identified opportunities for improving waste management, economic development, and land use planning.

**Business Case**

The Canadian Eco-Industrial Network has identified the business related economic benefits of industrial ecology as follows:\(^{16}\)

1. **Cost Savings and Enhanced Competitiveness** — Companies participating in an eco-industrial network can benefit from a wide range of potential cost savings. Increased efficiency typically involves new by-product exchanges and joint infrastructure projects with neighbouring facilities. For example, in Kalundborg, Denmark, a $60 million investment in eco-industrial network infrastructure generated $120 million in cost savings over five years.

2. **Revenue Generation** — Companies are sometimes unaware that their by-products have market value and can be sold rather than disposed of. For example, Chaparral Steel in Midlothian, Texas, produces slag which is used as an additive to cement produced by TXI. This by-product to resource conversion conserves natural resources while reducing energy requirements by 10 to 15 per cent. Revenue generation may also result from

improved market share. In France, a system has been developed that provides firms with an “eco-label” that identifies them as participants in a particular eco-industrial network.

3. **Improved Opportunities for New Investment** — The development of a flexible strategic plan for an eco-industrial network that includes baseline information on material and energy flows among existing firms can have a number of economic advantages for potential new investors. For example, several chemical companies are working to develop underutilized land holdings to attract new facilities that can utilize their products or by-products.

4. **Access to New Technology** — Greater cooperation between firms provides a supplier pathway for the diffusion of new technology across sectors and also helps stimulate new technological developments.

5. **Improved Human Resources** — Industry collaboration in Sarnia, Ontario, has resulted in a cooperative education program at Lambton College. There are 14 companies involved in the program, which have helped to set curriculum for a three-year co-op program and a 40-week course. The results are better trained people, opportunities to use co-op students and lower training costs. These factors result in higher productivity among workers, a better supply of well trained labour and improved worker safety, all of which are strategic advantages.

For government, the benefits include:
- enhancing the efficiency of resource use;
- enhancing recovery rates;
- reducing the cost of industrial infrastructure;
- supporting the sustainability of communities; and,
- identifying new economic development opportunities.
Burnside Industrial Park

A successful application of industrial ecology is the Burnside Industrial Park in Halifax, Nova Scotia. Burnside houses approximately 1,300 companies and 17,000 employees in those businesses. Burnside is designated primarily for light manufacturing, distribution, and commercial activities.

The Burnside Industrial Ecosystem project objectives and covenants are:
• to protect property values and enhance the investment of business located in the park by providing a well-planned and maintained development;
• to create an attractive and efficient business environment through sound land use, planning and environmental management standards; and,
• to ensure harmonious relationships among uses.

Objectives and covenants are to ensure that the park continues to be developed in a manner consistent with superior aesthetic and environmental protection standards and with the declared intention of creating a pleasant and harmonious environment for the park’s residents. Requirements apply to architecture, landscaping, signage, protection of natural areas, and buffer zones of undisturbed habitat or suitable green spaces around all watercourses.

The project researches and encourages strategies and instruments that will foster networking among businesses and their employees. The Eco-Efficiency Centre was established through a public-private-academic partnership to act as a catalyst in supporting more efficient and effective use of resources within the boundaries of the park. Current networking efforts include establishing shared material, packaging and transportation initiatives and carpooling programs.


Trends and Future Importance

According to Steven Peck, current government environmental policies are based around a regulatory foundation, but future initiatives are intended to be more cost-effective and innovative. Innovation is the most attractive response to global environmental problems. Innovation-friendly environmental policies will improve upon past policy experiments, increase research efforts, support decentralized decision making, rely on market-based solutions, remove barriers to individual initiative, provide incentives to environmental entrepreneurs, and provide public information to gauge the environmental performance of
economic actors. In short, such policies will encourage more rapid evolution in the industrial ecosystem.

Industrial Ecology and the development of technologies that eliminate waste and maximize efficiency will be critical to achieving the required reductions in material and energy throughput needed to maintain a basic quality of life into the 21st century. The extent to which these measures make economic, as well as ecological, sense (i.e., are eco-efficient) will determine whether market forces play a role as an important driver of change.\(^\text{17}\)

**Related Legislation and Regulations**

Local and regional laws that limit and discourage waste (e.g., tipping fees) support the industrial ecology approach.

**Linkages to Other Tools**

**Eco-Efficiency** — Many of the principles of eco-efficiency, when applied to a company’s operations and products complement those of industrial ecology and its emphasis on synergy with natural systems.

**Pollution Prevention** — Pollution prevention’s focus on reducing wastes and emissions complements industrial ecology’s focus on synergy between organizations within a specific region.

**Key References**

International Society for Industrial Ecology. www.yale.edu/is4ie.  

**Suggested Industry Best Practice Examples and Case Studies**

District heating: Bruce Energy Centre, Ont.; Cornwall, ON and Charlottetown, PEI.

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\(^\text{17}\) Peck, Steven W. Industrial Ecology: From Theory to Practice. New City Institute http://newcity.ca.
Green Procurement

Definition

Green procurement involves the purchasing of products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose. This comparison may consider raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, or disposal of the product or service.¹⁸

How is it Used?

Green procurement can range from simple to complex. In general, green procurement can take four main approaches within organizations:

• **Procuring eco-labelled products or services** — Although these eco-labeled products tend to be consumer commodity goods such as office supplies, cleaners and paints, many organizations procure eco-labeled or certified products/services as a simple first step towards green procurement.

• **In-house product/service evaluations** — Organizations, particularly in specialized areas (such as metals, chemical, services, substances), develop tools, procedures, standards and restrictions/bans for evaluating or screening the environmental performance of the goods or materials they purchase. These organizations combine specific regulatory requirements, safety, health, functionality and other existing product criteria in their evaluations.

• **Third-party product/service evaluation** — With this approach, an organization relies on a third-party to evaluate the products or services. For example, the Canadian firm Terra Choice evaluates and rates golf courses, marinas and hotels against a green leaf standard (more leaves indicate better environmental performance in that business category).

• **Supply chain initiatives** — This entails a combination of the approaches described above, but with the long term vision of “greening the supply chain” to achieve operational efficiency, risk reduction and cost savings.

Who Uses It?

**Industry** — Manufacturers implement green procurement to direct the selection of materials, components, products and suppliers. Industrial and consumer product manufacturers use green procurement, together with environmental supply chain management, to manage risk, reduce costs, improve environmental performance and fulfill policy objectives.

Government — Several governments have policies in place that prescribe the use of environmental standards in purchasing policies. For example, Environment Canada has a green purchasing policy that supports the integration of sustainable development into day-to-day activities of government departments. As part of the US Federal Government’s Environmentally Preferable Purchasing (EPP) program, all federal procurement officials are required by Executive Order 13101 and Federal Acquisition Regulation (FAR) to assess and give preference to those products and services that are environmentally preferable.

Business Case

There are many benefits that may be realized through implementation of green purchasing. These benefits can provide significant incentive for organizations (public or private) to adopt green procurement practices.

- **Cost avoidance** — The procurement of environmentally preferable products can lower waste management fees, lower hazardous material management fees and reduce spending on pollution prevention. For example, Bank of America’s green procurement program reduced the number of vendors it dealt with, and while also reducing paper consumption. The latter initiative is credited with savings estimated at $14 million in 1999.

- **Savings from conserving energy, water, fuel and other resources** — Energy, water and resource efficient products, buildings and vehicles and can significantly reduce utility bills and operating costs. For example, Interface Inc. has used life cycle studies and supply chain communication to enhance performance of its product, improve material efficiency and reduce operational costs.

- **Easier compliance with environmental regulations** — Environmentally preferable products, processes or services that utilize less toxic and hazardous materials or reduce harmful emissions can help organizations avoid expensive local permitting applications or environmental approvals from local/regional governments. This is of particular relevance to organizations with process, manufacturing or service facilities. For example, Canyon Creek Cabinet Co. avoided the costs of applying for and attaining an air operating permit by switching to a water-borne finishing system for the cabinets.

- **Reduced risk of accidents, reduced liability and lower health and safety costs** — Companies who use environmentally preferable products, materials or substances can improve worker health and safety while also reducing health risks and liability. Organizations can also reduce costs by avoiding listed (toxic) substances, thus eliminating reporting, training, handling, storing and disposal requirements. For example, Cape May County in New Jersey saved $45,000 by reducing its use of chemical insecticides and herbicides. Potential savings also exist for reducing the use of many pesticides.

• **Support of environmental/sustainability strategy and vision** — Governments have used green procurement as part of their role to promote environmentally responsible products and services. Private organizations see green procurement as a means of improving both environmental and social performance. For example, New York City Transit has adopted the “Sixth Pillar of Performance” in their Department of Capital Program Management to demonstrate environmental leadership within the public and private sector in New York State.

• **Improved image, brand and goodwill** — Organizations that have eliminated listed (toxic) substances from their products and production, such as Interface, may also benefit from positive coverage in the media and strengthen cooperative relations with suppliers in developing alternatives. For example, a small chain of Midas auto repair shops in Seattle has green buying as part of its customer satisfaction strategy. As a result, the shops have replaced hazardous vehicle fluids and cleaners with less hazardous substitutes.

• **Improved worker and community health** — Cleaner air and water, less demand for landfill and less demand for resources. For example, in the Pentagon, enhanced indoor air quality is expected to increase worker productivity by 6 per cent and save $72 million per year.
Public Transit and Green Power: Calgary’s *Ride the Wind Program*

Calgary Transit’s *Code of Practice* commits the transit authority to undertake business practices that exceed applicable environmental legislation, other environmental requirements and the City of Calgary’s Environmental Policy, and to integrate environmental considerations into its business planning and strategic decision making. As part of this commitment, Calgary Transit launched its *Ride the Wind Program*, becoming North America’s first wind-powered public transit system.

In September 2001, Calgary Transit entered into partnership with ENMAX and Vision Quest Windelectric Inc. to use wind-generated electricity from 12 windmills in southern Alberta to power its C-Train, the city’s light rail transit network. Although the C-Train itself does not produce CO\textsubscript{2} emissions, the electricity that powers the C-Train used to originate from coal or natural gas utilities, which do produce greenhouse gases.

It is estimated that switching to wind-generated power results in a reduction of CO\textsubscript{2} emissions by 26,000 tonnes annually. Plans are underway to extend the C-Train lines into areas currently not served by the system, which will generate additional CO\textsubscript{2} savings as people in those areas switch from road to public transit. While wind power is still more expensive than available conventional sources of electricity, Calgary Transit expects the additional cost of the *Ride the Wind Program* to be less than half a cent per passenger. A good deal for cleaner air.

City of Richmond, BC

The City of Richmond has earned a reputation as a "green" municipality by demonstrating leadership for the environment through a variety of policies, plans and actions. Two recent initiatives, the adoption of an Environmental Purchasing Policy, and preparation of the Environmental Purchasing Guide, are concrete examples of their on-going commitment to the environment.

The Environmental Purchasing Policy states that environmental considerations should be included in contract and tender specifications wherever possible. It allows for the consideration of environmentally labelled products. As well, the policy commits the City of Richmond to look at all the life cycle stages of products and use those that are more responsible to the environment. The policy requires that cost and quality must not be compromised for the sake of environmental attributes.

The Environmental Purchasing Guide puts the tools needed to implement the Environmental Purchasing Policy into the hands of staff.

The guide includes specific purchasing guidance for the following areas:
- general building maintenance;
- janitorial products;
- vehicles and maintenance;
- furniture and office systems;
- office equipment and related services;
- office supplies;
- lighting and lighting systems;
- construction, renovation, demolition;
- parks, recreation amenities and landscaping; and,
- special programs.

The guide also includes the Environmental Purchasing Policy, general guidance on environmental purchasing, sample specifications and reference materials.

Trends and Future Importance

Environmental criteria are becoming more common in purchasing decisions. This can be vitally important in some cases; for example, if companies bidding for contacts are equal in all other respects, environmental attributes may become the deciding factor in awarding the contract.

Related Legislation and Regulations

European Directive on Public Procurement
Executive Order to Buy Energy Efficient Computers
Executive Order on Federal Acquisition, Recycling and Waste Prevention

Linkages to Other Tools

Extended Producer Responsibility — End of life responsibility will require knowledge of materials that go into the product, which may be obtained through supply chain management.

Design for Environment (DfE) — DfE projects may be undertaken in cooperation with suppliers.

Environmental Management Systems (EMS) — Working with suppliers is a frequent component in EMS; companies may require suppliers to comply with the same type of EMS that they themselves have implemented.

Environmental Labelling — Purchasers may use environmental labels to identify environmentally preferable products and services.

Key References

Environment Canada Greener Procurement
Supply Chain Management for Environmental Improvement
US EPA Environmentally Preferable Purchasing
Japan’s Green Purchasing Network
National Pollution Prevention Roundtable's Environmentally Preferable Purchasing Workgroup
Pacific Northwest Pollution Prevention Resource Center
New Paths to Business Value

Existing Case Study Sources

Ikea Case Study
EPA Environmentally Preferable Purchasing Case Studies
Finnair Travel Services Case Study
It’s Not Easy Going Green, Organic Cotton Case Study
Green Procurement Policy, AMKC
New York City Transit, Department of Capital Program Management

Possible Case Study Sources

Interface Case Study
City of Ottawa
Ericsson
Hewlett Packard
IBM
City of Richmond, BC
Extended Producer Responsibility

Definition

The Organization for Economic Co-operation and Development (OECD) defines extended producer responsibility (EPR) as, “An environmental policy approach where the producers’ responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product’s life cycle. Producers accept their responsibility when they design their products to minimize life cycle impacts and when they accept legal, physical and/or economic responsibility for the environmental impacts that cannot be eliminated by design. A primary function of EPR is the transfer of the costs and/or physical responsibility (full or partial) of waste management away from local government authorities and the general taxpayer to that of the producer.”

EPR can be government-driven (with a regulatory backdrop) or voluntary initiatives whereby producers take responsibility for managing the end-of-life aspects of their products.

How is it Used?

The basic principles for implementing EPR and related product policy programs are as follows:

- the extension of responsibility to create effective feedback to product designers stimulating the design of cleaner products;
- life cycle approach directed at producing life cycle benefits, so that environmental impacts are not increased or transferred somewhere else in the product chain;
- a well-defined focus of responsibility;
- a policy tailored to the specific attributes of the product system being targeted; and,
- the extension of responsibility to increase communication among actors in the entire product chain about the life cycle impacts of the product.

In practice, the term has mostly been used to describe producer responsibility “post-consumer” — after products have been discarded at the end of their useful life. As such, EPR shifts the responsibility for discarded materials that would otherwise be managed by local government to private industry, thereby incorporating the costs of product disposal or recycling into product price. In most countries, EPR is first applied to packaging and then to other products.

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OECD’s Fifteen Guiding Principles for an Effective EPR Program

1. EPR policies and programmes should be designed to **provide producers with incentives** to incorporate changes upstream at the design phase in order to be more environmentally sound.

2. Policies should stimulate **innovation** by focusing more on results than on the means of achieving them, thus allowing producers flexibility with regard to implementation.

3. Policies should take a **life cycle approach** and be directed at producing life cycle benefits, even if they focus on the post-consumer phase, so that environmental impacts are not increased or transferred somewhere else in the product chain.

4. **Responsibilities** should be well-defined. They should not be diluted out of existence across all the actors in the product chain.

5. Policies should be **product specific**. One type of programme or measure is not applicable to all products, product categories or waste streams.

6. Extension of producer responsibilities should take place in such a way as to increase **communication** among the actors in the entire product chain concerning the product’s life cycle impacts.

7. A **communication** strategy should be devised to inform all the actors in the product chain as well as consumers, about the programme and enlist their support and co-operation.

8. To enhance a program’s acceptability and effectiveness, **consultation of stakeholders** about its goals and objectives as well as estimates of its costs and benefits should be conducted.

9. **Local governments** should be consulted in order to clarify their role and obtain their advice concerning the program’s operation.

10. Both **voluntary and mandatory approaches** should be considered, with a view to meeting national environmental goals and objectives in the best way possible.

11. A **comprehensive analysis** of the EPR programme should be made (e.g., which products, product categories and waste streams are appropriate for EPR, whether historical products should be included, and the roles of all actors in the product chain).

12. EPR programmes should undergo periodic **evaluations** and be flexible enough to be adapted by government in response to these evaluations.

13. Programmes should be designed and implemented in such a way that environmental benefits are obtained while domestic **economic dislocations** are avoided.

14. The process of developing and implementing an EPR strategy, and putting it into operation, should be based on **transparency**.

15. Stakeholders should agree on a **compliance** mechanism that best meets the program’s goals and objectives.

Who Uses It?

**Industry** — Typically, producer responsibility initiatives involve voluntary product take-back by the original manufacturer at the end-of-life. Such responsibility for product end-of-life leads manufacturers to carefully consider material selection and design for disassembly initiatives. In the case of government programs, recovery targets are set and the provision of disassembly guidance to dismantlers is often mandatory.

**Government** — There is still some debate over the definition of EPR. For example, some jurisdictions have interpreted EPR as manufacturers taking responsibility for used packaging and products (e.g., Japan, Australia), other jurisdictions (e.g., Sweden) interpret EPR to mean that producers should assume responsibility for manufactured or imported goods throughout their life cycle, including the waste phase. The OECD has recognized that EPR can include government-driven programs with a regulatory backdrop or they can be voluntary initiatives where producers take responsibility for managing the end-of-life aspects of their products. Some jurisdictions look at EPR in terms of a shared responsibility between industry, government and consumers. Many countries in Europe are implementing the waste electronics and electrical equipment (WEEE) directive and are moving towards a shared responsibility including requiring consumers to pay deposit fees.

### Table 1: Example EPR Approaches

<table>
<thead>
<tr>
<th>Type of EPR</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>Product take-back programs</td>
<td>Mandatory take-back; Voluntary or negotiated take-back programs.</td>
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<tr>
<td>Procurement/ consumer programs</td>
<td>Procurement guidelines and policies; Information disclosure programs.</td>
</tr>
<tr>
<td>Regulatory approaches</td>
<td>Disposal bans; Mandated recycling.</td>
</tr>
<tr>
<td>Voluntary industry practices</td>
<td>Voluntary codes of practice; Public/private partnerships; Leasing and &quot;servicing&quot; (in which companies lease their products or provide services, thereby retaining ownership of the product).</td>
</tr>
<tr>
<td>Economic instruments</td>
<td>Special taxes; Product charges; Advance disposal fees; Deposit/refund schemes; Subsidies and tax credits for the production and use of environmentally preferable products.</td>
</tr>
</tbody>
</table>
Business Case

Properly designed EPR policy can be a driving force for waste avoidance and associated pollution reduction throughout many sectors of the economy. Further benefits could include:\textsuperscript{23}

- reducing the number of landfills and incinerators;
- reducing the waste management burden on municipalities;
- fostering recycling and reuse of products or parts thereof;
- improving the ease and timeliness of disassembling products for recycling or reuse;
- reducing or eliminating potentially hazardous chemicals in products;
- promoting cleaner production and products;
- promoting more efficient use of natural resources;
- improving relations between communities and firms;
- encouraging more efficient and competitive manufacturing;
- promote integrated environmental management by placing emphasis on product life cycle; and,
- improving materials management.

Sony, WMI and the Minnesota Electronics EPR Initiative

Sony and the electronics industry, in general, are facing a number of issues that are driving the integration of environmental considerations into industrial practice. Drivers include pressure for recycling, market demand, eco-labelling requirements, legislative requirements for materials handling, emissions and product take-back, increasing costs for resource use and competitive pressures. Sony has a world class product development process that includes a product assessment process that examines environmental impact throughout the life cycle including use and end-of-life disposal.

In October 2000, Sony Electronics announced that it was teaming up with the Minnesota Office of Environmental Assistance (MOEA) and Waste Management, Inc. (WMI) to develop a take-back and recycling program for end-of-life electronics. Consumers in Minnesota can now return their outdated Sony brand electronic equipment to the company through WMI’s existing waste disposal network free of charge. WMI will process the electronics and sell the scrap for profit. The glass from cathode ray tube (CRT) monitors will be sent to a WMI facility in Pennsylvania where it will be cleaned and then resold to Sony Electronics for reuse in the manufacture of new CRTs. Plastics will also be disassembled and sold after a sufficient amount of consistent grade plastic has been collected to market as secondary material for the manufacture of new products.

Sony Electronics’ chief operating officer has committed to “a shared responsibility for the products of the past,” and also stated “taking back and recycling products helps Sony design future devices that cost less to manufacture and help save our precious natural resources. It’s a win-win situation.”

A key to the success of this type of program will be to ensure that products have a higher value at the end of life. This value is influenced by the design of the product, the value of the materials or component parts in the product and the presence of a “reverse infrastructure” that reduces the collection, recovery (materials) and reuse (components) of the product.

Sony Electronics was selected as the inaugural recipient of the US Environmental Protection Agency’s Energy Star® Home Electronics “Partner of the Year” award in 1999. This program is significant in that it demonstrates a voluntary approach to EPR and it also links EPR with design.

Trends and Future Importance

Existing and emerging EPR policies do not share a common definition of “producer.” There is considerable variation in how the producer is identified, although usually it is the company whose brand name appears on the product. Debate continues as to who should take responsibility for historical or orphaned waste — waste that was produced 20 or 30 years ago. Many companies are reluctant to take responsibility for the waste of other manufacturers who may no longer exist or are competitors or for products that were not designed with recycling or recovery in mind.

Initiatives such as the End-of-Life Vehicle (ELV) and Waste Electrical and Electronic Equipment (WEEE) directives are defining and driving the uptake of extended producer responsibility. The EU is implementing extended producer responsibility programs directed at consumer products. These initiatives will grow in importance in North America starting with voluntary approaches.

Related Legislation and Regulations

The various countries that have mandated EPR have imposed somewhat different requirements, making it very complex for companies that do business multinationally. However, efforts are now underway, particularly in Europe, to harmonize EPR laws.

In Canada, some provinces are exploring landfill bans of electronic and electrical equipment while the Electronic Product Stewardship Canada has been mandated to address residential electronic waste in Canada. These initiatives are a signal to Canadian manufacturers of the early stages of EPR activities.


Linkages to Other Tools

Integrated Product Policy — EPR is one of the concepts promoted in an integrated product policy.

Key References

Extended Producer Responsibility web links — www.informinc.org/eprgate.htm
UN and Extended Producer Responsibility — www.uneptie.org/pc/pc/tools/epr.htm

Existing Case Studies
European End of life Vehicle Directive
Waste Electronics and Electrical Equipment Directive
Xerox Manufacturing Program

**Suggested Industry Best Practice Examples and Case Studies**

Responsible Care
Automotive Take-back Initiatives
German Green Dot System
Mercury Thermometer, Thermostat or Switch Recovery and Take Back Programs
Sony
Environmental Supply Chain Management

Definition

Programs that intend to bring about environmental improvement can often be most efficiently implemented if the whole product chain, or system, is involved. Environmental supply chain management (ESCM) involves the organization of activities to address the performance of material, components, goods and services that an organization buys and uses. At its most developed, ESCM involves identifying the most significant environmental improvement opportunities by considering the entire product system and working cooperatively with suppliers to reduce environmental impact.

There are three dimensions to environmental supply chain management:

- supply chain — Network involved, through upstream and downstream linkages, in processes and activities delivering value in the form of products to users (ISO 14062);
- environmental — Materials, energy inputs and outputs and their related environmental impacts/aspects; and,
- management: the conducting or supervising of a business/organization.

How is it Used?

Often, organizations applying ESCM impose certain requirements to bring suppliers in line with the organization’s standards of environmental management. Requirements may be specific, such as lists of substances that are banned, restricted or targeted for phase out or specifications on recycled content. There may also be broader requirements, such as conformance to an environmental management system. For example, Ford, General Motors and DaimlerChrysler have mandated that their tier one suppliers must implement environmental management systems in conformance with ISO 14001. In general environmental supply chain management requirements address one or more of the following elements:

- energy efficiency;
- material and resource management, efficiency and control;
- safe and clean production;
- distribution and logistics;
- total costs;
- risk and liability;
- secure supply; and,
- innovation management.

While the above approach is common, there are other ways that ESCM is used. In some cases, a collaborative approach is utilized where organizations and suppliers work together to improve environmental performance in both organizations. For example, if the procuring organization has particular expertise to share, they may organize training session for their
suppliers. On the other hand, a supplier with environmental programs may approach its customer, in search of recognition or supply chain partnerships.

In summary, companies using ESCM are managing their supply chains by:
• imposing product/material/system requirements;
• using questionnaires to assess performance of suppliers;
• collaborating to coordinate environmental goals and identify improvement opportunities; and,
• training.

Who Uses It?

Industry — Activity is growing in the multi-national automotive and electronics sectors and this is being driven by regulatory responsibility for products at the end-of-life (in certain jurisdictions) and material bans. The building and construction sector is also active, driven by a small but growing trend to evaluate building performance from an environmental perspective.

Government — Many government bodies, at all levels, are influencing their suppliers through environmental requirements, primarily through green procurement programs.

Business Case

Effective supply chain management is an important part of successful business operations.

_ Buyers are forging stronger relationships, alliances and partnerships throughout the supply chain in an effort to obtain ensured supply, leverage, inventory management and better quality._

> Christopher Reilly, Purchasing.com

Integrating specific environmental considerations into existing practices will generate further value, both within the organization and in its relationships with suppliers. For suppliers, understanding and meeting environmental requirements of their customers can be a way of developing deeper relationships with their customers and increasing market share.

It is important to recognize that a company’s responsibility for its products can extend beyond its in-house manufacturing activities. Hazardous materials that are included in components obtained from upstream suppliers may affect a company. For example, a computer company lost a sales opportunity when it was discovered that its computers contained a hazardous substance that was banned by the purchaser. The company was unaware that their suppliers were using this material.

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The loss of market access is not the only reason to track environmental performance of suppliers. Other potential area of business value include, reduction in energy and material use, decreased occupational health and safety risks, ensured security of supply, reduced risk and liability, and innovation opportunities. An example of business benefits is Nissan’s North American Operations (NNAO). Located in Smyrna, Tennessee, NNAO plant managers decided to require greater accountability for packaging waste from their suppliers. They did so by offering suppliers long term, secure contracts that gave them greater stability and predictable revenues. The Nissan plant managers also worked very closely with their suppliers to ensure they understood the environmental and financial benefits of using reusable containers and reducing wastes. By the mid 1990s, over 97 per cent of 9,750 different parts shipped into the Smyrna plants arrived in reusable containers. Partly because of this SCM initiative, Nissan decreased the amount of parts in its inventory by 40 per cent in two years and suppliers, in turn, received secure revenue, guaranteed business and environmental management training.
Patagonia

Patagonia is a California based company that manufactures outdoor sports clothing. The company is known for its many environmental initiatives. One of the most significant ones, which involved suppliers to a large degree, was its decision to switch from conventionally grown to organically grown cotton.

In 1991, the company started a comprehensive environmental review to examine all of the methods and materials used in clothing. The company promised to continue to seek those materials and processes that lessened its environmental impact.

In the early 1990s, Patagonia studied the impacts of four types of fibres used in their products: polyester, nylon, cotton and wool. Perhaps surprisingly, cotton was found to have the greatest environmental impacts throughout its life cycle largely due to the extensive use of chemicals in the conventionally farmed cotton. This led the board of directors in 1994 to decide to switch to 100 per cent organically grown cotton. By 1996, the entire sportswear line had been converted to organic cotton.

In 1996, Patagonia held a three-day supplier conference. They invited suppliers from around the world, from every company involved in making Patagonia products. The conference was modeled on an earlier supplier conference focused on quality. This time the focus was on opportunities to reduce environmental impact, and one of the major topics was organic cotton. Patagonia used a persuasive presentation to demonstrate their reasons for switching to organic cotton: first showing the effects of conventional cotton production, and then showing photographs of their children which suppliers had been asked to provide in advance. They asked suppliers to work with them to develop the knowledge that would be needed to follow through on the decision to use organic cotton. This appeal was successful, and cotton is now the least damaging fibre used.

Patagonia's work with their supply chain has been a positive experience for both the company and its suppliers; rather than being prescriptive, Patagonia calls it "co-venturing." It has allowed Patagonia to pursue its environmental vision.

Sources: Patagonia, Enviro Action www.patagonia.com
Trends and Future Importance

The concept of overall supply chain management is becoming more and more important, and increasingly environmental aspects are being incorporated into this area. Companies are under greater pressure than ever to be aware of what is in their products and how they are made. Table 1 illustrates the current trends in environmental supply chain management in industry.

Table 1: Supply Chain Management Trends

<table>
<thead>
<tr>
<th></th>
<th>First Generation</th>
<th>Second Generation</th>
<th>Next Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategy/Drivers</strong></td>
<td>Reduce liability and risk from suppliers’ policies, facilities and compliance record.</td>
<td>Reduce costs and liabilities associated with suppliers’ products.</td>
<td>Partner with suppliers to optimize supply chain and exploit opportunities.</td>
</tr>
<tr>
<td><strong>Systems</strong></td>
<td>EMS maturity documented.</td>
<td>EMS requirements specified.</td>
<td>Some integration of supplier EMS with customer EMS.</td>
</tr>
<tr>
<td><strong>Programs</strong></td>
<td>Pollution prevention.</td>
<td>DfE guidelines/checklists; Product take-back.</td>
<td>LCA; Systematic DfE; Better linkage to product development processes.</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>Self assessments; Questionnaires; Labels.</td>
<td>Restricted material lists; Product declarations; Audit protocols; Scoring protocols.</td>
<td>More integration and transparency in tools already in use for design, purchasing, engineering, etc.</td>
</tr>
<tr>
<td><strong>Data</strong></td>
<td>Facility level assurance (1st party).</td>
<td>Product data assurance (1st party).</td>
<td>Verification of performance; Common data architecture standards for LCI and other data; Data integration, consistency, transparency, and confidentiality.</td>
</tr>
</tbody>
</table>

Managing supply chain issues is extremely complex and there are a number of issues that will affect the growth of ESCM as a tool for meeting business objectives and improving environmental performance. Companies often have diverse suppliers that can range from multinationals to SMEs. Another challenge is designing adequate incentives (internally and externally) and insuring that requirements are met and that data is reliable. Overcoming these and other issues will affect future use of the tool.

Related Legislation and Regulations

European Directive on Public Procurement
Executive Order to Buy Energy Efficient Computers
Executive Order on Federal Acquisition, Recycling and Waste Prevention
Linkages to Other Tools

Extended Producer Responsibility — Responsibility for products at the end of their life will require knowledge of the materials that go into those products; this information may be obtained through supply chain management.

Design for Environment (DfE) — DfE projects may be undertaken in cooperation with suppliers.

Environmental Management Systems (EMS) — Working with suppliers is a frequent component in EMS; if a company is going to meet its EMS goals, it may require suppliers to comply with a similar EMS program.

Environmental Labelling — Purchasers may use environmental labels to identify environmentally preferable products and services.

Green Procurement — Also known as environmental preferable purchasing, green procurement ranges from (1) procuring “eco-labelled” products or services; (2) conducting in-house product/service evaluations; (3) enlisting third-parties to evaluate products/services; to (4) more comprehensive environmental supply chain management initiatives.

Key References

Environment Canada Greener Procurement
Supply Chain Management for Environmental Improvement
US EPA Environmentally Preferable Purchasing
Japan’s Green Purchasing Network
National Pollution Prevention Roundtable's Environmentally Preferable Purchasing Workgroup
Pacific Northwest Pollution Prevention Resource Center
New Paths to Business Value

Existing Case Study Sources

Ikea Case Study
EPA Environmentally Preferable Purchasing Case Studies
Finnair Travel Services Case Study
It’s Not Easy Going Green, Organic Cotton Case Study
Green Procurement Policy, AMKC
New York City Transit, Department of Capital Program Management
Possible Case Study Sources

Nissan
Siemens NAMO (North American Motor Operations)
Imperial Pulp and Data Corporation
Volvo
Ericsson
Magna and 3M
Staples
Starbucks
Home Depot
Environmental Risk Assessment

Definition

Environmental risk assessment (ERA) involves the examination of risks resulting from natural events (flooding, extreme weather events, etc.), technology, practices, processes, products, agents (chemical, biological, radiological, etc.) and industrial activities that may pose threats to ecosystems, animals and people. Environmental health risk assessment addresses human health concerns and ecological risk assessment addresses environmental media and organisms. ERA is predominantly a scientific activity and involves a critical review of available data for the purpose of identifying and possibly quantifying the risks associated with a potential threat.

How is it Used?

Identification of an emerging issue or priority for further action can result in a demand for ERA to determine whether an initial indication of a problem is valid or not. ERA provides the basis for most legislative and regulatory programs as well as for international agreements to address identified threats. While approaches vary significantly from one situation to another, and from one jurisdiction to another, international organizations are making efforts to bring some commonality to the approaches used.

If a threat to human health or the environment is identified through ERA, risk management is performed to consider the need to impose measures to control or manage the risk. While science remains an important factor at this third stage, other key factors must also be considered such as: socio-economic considerations; the availability of alternative technology, products, practices, processes, etc.; international comparisons and impacts; and communication and consultation with the public and stakeholders that will be affected by proposed changes. In many ways, this stage is the most complex.
ERA can be used in a number of ways.

- **Prioritization of Risks** — When an organization is faced with a number of potential environmental risks, ERA can be used to establish their relative importance, and thus provides a basis for prioritizing which risks should be dealt with first.

- **Site-specific Risk Evaluation** — ERA can be used to determine the risk associated with locating facilities in specific locations or to determine the risks that affect a particular site (e.g., environmental site assessment).\(^{25}\)

- **Comparative Risk Assessment** — ERA is used to compare the relative risks of more than one course of action (e.g., what are the risks posed by untreated water versus the risks posed by chemicals used to treat water).

- **Quantification of Risks** — ERA may be taken to the point where the risks are quantified in order to establish controls on the risks (e.g., maximum acceptable concentrations for chemicals in ambient or drinking waters).

There are many approaches to conducting ERA.\(^{26}\) Figure 1 depicts an overall framework developed by the Canadian Standards Association. This framework highlights the importance of risk communication, in which stakeholders are involved throughout the process, from identification and priority setting, to ERA, to risk management, to monitoring and evaluation of the implemented measures.

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\(^{25}\) The Canadian Standards Association gives the following definitions: Phase I Environmental Site Assessment (ESA) — the systematic process by which an Assessor seeks to determine whether a particular property is or may be subject to contamination. Phase II Environmental Site Assessment (ESA) — the systematic process by which an Assessor seeks to characterize or delineate the levels of contaminants of concern related to a site. Phase II ESAs may be used to confirm or refute the findings of a Phase I ESA, gather information in support of remedial measures or site redevelopment, make informed decisions about property transactions, or to establish a baseline of environmental conditions.

\(^{26}\) An exhaustive overview of all ERA approaches is outside the scope of this document. For such an overview, see *Risk Assessment Methods: Approaches for Assessing Health and Environmental Risks*, V. Covello and M. Merkhofer, 1993.
Figure 1: Risk Management Framework

1. **Initiation**
   - Define problem or opportunity and associated risk issue(s).
   - Identify risk management team.
   - Assign responsibility, authority, and resources.
   - Identify potential stakeholders and begin to develop consultation process.

2. **Preliminary Analysis**
   - Define scope of decision(s).
   - Identify hazards using risk scenarios.
   - Begin Stakeholder Analysis.
   - Start the risk information library.

3. **Risk Evaluation**
   - Estimate and integrate benefits and costs.
   - Assess stakeholder acceptance of risk.

4. **Risk Estimation**
   - Define methodology for estimating frequency and consequences.
   - Estimate frequency of risk scenarios.
   - Estimate consequences of risk scenarios.
   - Refine Stakeholder Analysis through dialogue.

5. **Risk Control**
   - Identify feasible risk control options.
   - Evaluate risk control options in terms of effectiveness, cost, and risks.
   - Assess stakeholder acceptance of proposed action(s).
   - Evaluate options for dealing with residual risk.
   - Assess stakeholder acceptance of residual risk.

6. **Action/Monitoring**
   - Develop an implementation plan.
   - Implement chosen control, financing, and communication strategies.
   - Evaluate effectiveness of risk management decision process.
   - Establish a monitoring process, sunset, terminate as applicable.

Who Uses It?

Industry — Industry employs ERA to satisfy regulatory requirements, to make decisions on the use of substances and processes, and to locate facilities and operations based on the risks to human health and the environment. The resource extraction sector (mining, oil and gas) and the chemical manufacturing sector are regular users of ERA tools as these provide mechanisms for assessing the risk of environmental damage and implementing risk management or avoidance strategies.

Government — Government bodies use ERA to implement, or determine the need for, legislation, regulations or other controls to protect human health and/or the environment.

Finance — Financial organizations such as banks, investment firms and insurance firms, use ERA to define the financial risk associated with the environmental risks of potential investments. This information is included in the decision making process for the approval or rejection of loan and investment applications, and for setting premiums, interest rates and projected returns. Environmental site assessment is a common tool employed by the financial sector for assessing the environmental management responsibilities and potential costs associated with ownership of a given property.

Academia and NGOs — Universities and NGOs conduct research on industrial and other human activities using ERA.

Business Case

ERA is an important tool for a number of reasons. For governments, it provides a method for determining risks to the public and the environment, and the process is communicated to the public to ensure transparency and understanding. The concept is already incorporated into some legislation and is also applied through policy and in developing new legislation.

ERA is also used in industry beyond what is implemented through legislation, and it is used to make decisions on materials, processes and facility siting. The process has several advantages:

- identification of trade-offs when examining comparative risks;
- avoidance of liability; and,
- disclosing the financial costs associated with risks.

ERA is often made difficult by the large degree of uncertainty that frequently accompanies the data. However, the environmental risk assessment and management process offers a course of action for making the best decision possible with the data that is available.
New Substance Notifications Regulations

The New Substances (NS) Program performs the risk assessments and manages chemicals and polymers when risks are identified, under the authority of the New Substances Notification (NSN) Regulations. The NSN Regulations require importers and manufacturers to notify Environment Canada of substances and activities new to Canada. The information that notifiers must submit to government is described in regulatory "schedules." The type of information required and the timing of the notification will depend on such factors as the type of substance, the quantity that will be imported or manufactured, the intended use of the substance and the circumstances associated with its introduction. The notification packages typically include test data relating to physicochemical properties, environmental fate and behaviour and/or toxicity.

Environment Canada is responsible for the administration of the NS Program, the assessment of potential risks to the environment, development and implementation of controls, compliance promotion and enforcement. Some of the environmental risks that are considered include aquatic toxicity and biodegradability. Health Canada carries out the assessment of potential risks to human health. These include acute human toxicity, skin sensitization and mutagenicity, among others.

The assessment process results in either:
- a determination that the substance is not suspected of being "toxic" or capable of becoming "toxic;"
- a suspicion that the substance is "toxic" or capable of becoming "toxic;" or,
- a suspicion that a significant new activity (SNAc) may result in the substance becoming toxic if there was adequate information available to assess it.

Substances suspected of being toxic may be controlled by one of the measures set forth in CEPA including:
- controls on import and manufacture;
- the prohibition of import and manufacture; or,
- prohibition pending submission and assessment of additional information determined to be required by the departments.

When it is suspected that a significant new activity (SNAc) in relation to the substance may result in the substance becoming toxic, a SNAc Notice may be issued for the substance. The NS Program is considered a leader and the NSN Regulations one of the most stringent laws dealing with new chemicals.

Trends and Future Importance

One of the challenges of environmental risk assessment is the existence of many different methodologies. A couple of approaches that are being investigated to overcome this in the area of chemicals are harmonization of chemical assessment methods and mutual recognition of data used in assessments. As well, there is movement to reduce uncertainty in risk assessments and to increase transparency and public involvement. International trade is driving the cooperative efforts of national governments to develop alignment between national ERA programs, with similar impacts on risk management measures.

Related Legislation and Regulations

Canadian Federal legislation
Canadian Environmental Assessment Act and Regulations
Federal-Provincial Environmental Assessment Agreements
Canadian Environmental Protection Act
Pest Control Products Act

Linkages to Other tools

Precautionary Principle — A concept for managing the risks identified by a risk assessment; calls for the use of a precautionary approach when threats to human health and the environment are identified, even if cause and effect relationships are not fully established.

Life Cycle Assessment/Management — A thorough ERA will take into account the entire life cycle of the subject under study in order to determine all possible risks that it may pose.

Key References

Environment Canada, Environmental Assessment
Health Canada (CEPA) Existing Substances Assessment Program
Environment Canada (CEPA) Priority Substances Assessment Program
Network for Environmental Risk Assessment and Management
US EPA, National Center for Environmental Assessment, Guidelines for Ecological Risk Assessment

Existing Case Study Sources

National Round Table on the Environment and the Economy — Health, Environment and Economy Case Studies
Galveston Bay ERA Case Study
Hawaii Case Study
EPA Place-Based Risk Assessment Case Studies

Possible Sources of Case Studies

Evaluation of cleaning compounds (Proctor & Gamble, Unilever, SC Johnson)
Chemical risk assessment in the EU, Sweden or Australia
CEPA Priority Substances List Assessment Program
Phase I, II and III site assessment process
Corporate Environmental Reporting

Definition

Organizations engage in environmental reporting as a means to publicly demonstrate their commitment to environmental responsibility and to provide information on their environmental performance and initiatives. In Canada, environmental reporting is voluntary and focuses on the environmental impact of organization-level activity. Environmental reporting refers to the release of environmental performance information to the general public, as opposed to the submission of data/reports strictly to government. Environmental reporting can take several forms, including the publication of hard copy or web-based reports.

Principles of environmental reporting include:\(^{27}\)
- transparency;
- accuracy;
- clarity;
- inclusiveness and completeness;
- verifiability and auditability;
- timeliness;
- relevance to the concerns of stakeholders;
- comparability (to facilitate comparison over time and between organizations); and,
- neutrality.

These same principles apply to sustainability reporting (i.e., reporting on environmental performance, together with economic and social performance and business practices).

How is it Used?

Like financial reporting, environmental reporting forces a high level of organizational transparency. This allows for feedback from informed stakeholders on the environmental performance of an organization. Senior management often uses environmental reporting as a mechanism to review environmental performance and establish targets and action plans for further improvement.

A variety of stakeholders use corporate environmental reports to assess the performance of companies. Environmental reports provide insight into how well a company is managing its operations to reduce risk, avoid potential liabilities, satisfy public and other stakeholder expectations, and pursue innovative solutions. Environmental reports provide more than just insight into the environmental performance of an organization; they offer an understanding of the overall environmental management framework used by the company.

Environmental reporting is becoming increasingly common, and is now being utilized by several sectors, including private companies, academic institutions and local government. Environmental reports often contain a number of common elements:28

- introduction from the chief executive;
- background information about the organization;
- the organization’s environmental policy;
- the organization’s overall performance with regard to the environment (frequently broken down into smaller business sections for large organizations);
- progress made towards specific targets established in previous reports; and,
- setting of targets for improving the organization’s environmental performance.

**Who Uses It?**

**Industry** — Environmental reporting is a mechanism used by companies across all sectors of the economy to communicate environmental initiatives and performance to stakeholders. Customers, investors, regulators, community groups, employees, environmental activists, trading partners and other interested parties are asking companies for more, and more detailed, information about their environmental performance. Meeting the information needs of these stakeholders is encouraging the implementation of environmental reporting by companies. Environmental and reporting has become standard practice in many large companies and sometimes is included with financial and social information in an overall sustainability report.

**Government** — Governments promote the use of environmental reports by business as a means of ensuring transparency and responsible corporate behaviour. Government agencies and departments prepare their own environmental reports as a means of informing the public of their own operations and how environmental considerations are taken into account in the decision-making process.

**Financial Community** — Banks and insurers are increasingly interested in environmental risks and liabilities, and are turning to corporate environmental and sustainability reports to gauge companies’ environmental management and performance. Companies that demonstrate they are acting to reduce environmental and social risks and future liabilities can benefit from improved credit ratings and lower premiums.29 Mutual funds that utilize social and environmental screens also use environmental and sustainability reports to evaluate companies for inclusion in their funds and to compare a company’s performance against other companies in the sector.

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Business Case

Over the last decade, a growing number of companies have recognized the business benefits of improving the triple bottom line of economic, environmental and social performance. Their experiences are supported by a growing body of empirical studies that demonstrate that environmental performance has a positive impact on business economic performance. Many of these improvements arise internally, through improved efficiencies and lowered costs. Benefits also arise through companies effectively communicating their commitments, policies and practices related to improving their environmental performance and providing performance measures with which to gauge their progress. Companies that perform well, but communicate poorly, risk under-leveraging their assets. Many companies that publish comprehensive reports believe such quality reporting helps build strong corporate reputations and brand images. Some companies even go an extra step and link a reputable brand image indirectly to more sales. Corporate environmental reporting, therefore, becomes a key ingredient in maximizing the benefits that corporate responsibility can offer.

Public reporting can act as a competitive differentiator for companies seeking access to markets and capital, and as mainstream institutional investors and financial analysts rely more heavily on environmental reports in making investment decisions. As Innovest executive managing director Matthew Kiernan notes, this is because “a company’s environmental and social performance is an increasingly potent proxy and leading (i.e., predictive) indicator” for three typically under-weighted drivers critical “to future profitability potential: corporate agility or adaptability; the durability of a firm’s competitive advantage; and the quality of its strategic management.”

The process of reporting, itself, can help drive improvements within an organization. It can provide a baseline from which progress can be measured and allow peer comparisons internally between operations, as well as externally with other corporations. It can also help align values and activities internally, by raising internal awareness of the company’s values, commitments and activities with respect to sustainable development. Reporting also forces discussion of dilemmas facing companies in reconciling diverse economic, social and environmental goals.

Companies that demonstrate they are engaging in practices that satisfy and exceed regulatory compliance requirements are subject to less scrutiny and given greater latitude by both national and local governments. Regulators increasingly are applying risk-based inspection frequencies (i.e., the more likely you are to pollute, the more often you will be inspected).

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30 Innovest is an internationally recognized investment research firm specializing in environmental finance and investment opportunities. It currently has approximately US$450 million under direct sub-advisement and provides custom research and portfolio analysis to leading institutional investors and fund managers throughout the world. For more information visit www.innovestgroup.com.

Suncor

Suncor commitment to Sustainability
www.suncor.com/bins/content_page.asp?cid=52

Suncor has a declared commitment to social and environmental responsibility. Suncor's vision is to become a sustainable energy company. The company has committed to providing energy solutions that meet or exceed the environmental, economic and social needs of customers and other stakeholders, while contributing to the ability of future generations to meet their needs. As part of this vision, Suncor has adopted a parallel path approach to making the most of current and emerging energy opportunities. One path is to continue with responsible development of the hydrocarbon resources still demanded by consumers. The other path is to pursue opportunities in renewable energy — including investing at least $100 million by 2005 to begin producing energy from sources such as wind power. Suncor’s vision of sustainable development includes identification of innovative ways to eliminate waste, reduce environmental impacts and improve social performance.

In order to effectively communicate corporate environmental initiatives, Suncor produces annual sustainability reports based on the Sustainability Reporting Guidelines of the Global Reporting Initiative (GRI) for voluntary reporting on environmental, economic and social performance. Suncor believes that communicating effectively with stakeholders provides definite advantages:

- Early identification of problems, needs and constraints increases opportunities for timely resolution of issues;
- Listening and acting on the input received can improve business decisions and performance; and,
- Engaging stakeholders helps maintain its social license to operate and grow.

Suncor believes that stakeholders have the right to be informed about business operations and to be involved in decisions that are important to them.

Trends and Future Importance

Environmental reporting has traditionally been a voluntary method of communicating environmental performance to stakeholders. More recently, there has been movement towards making environmental reporting mandatory. Denmark, New Zealand, France and the Netherlands have already started introducing legislation on environmental reporting. The voluntary European Eco-Management and Audit Scheme (EMAS) also requires that companies certified to the standard produce environmental statements. The international
environmental management system standard ISO14001, however, does not specify that company environment performance data be made public.

Related Legislation and Regulations

Denmark adopted legislated public environmental reporting requirements in 1996 mandating approximately 3000 companies to publish environmental reports. Norway has legislated the inclusion of environmental information in corporate annual financial reports.

Canadian reporting requirements began with the mandatory reporting of toxic emissions as part of the National Pollutant Release Inventory (NPRI). This type of requirement may mark the beginning of full environmental disclosure to government and the public.

Linkages to Other Tools

Environmental Management Systems — Often, the policy, goals, targets, data and information used within an EMS to drive continuous environmental improvement can be used as the basis of a corporate environmental report.

Key References

Standards for environmental/sustainability reporting include:
- The Global Reporting Initiative (GRI) established by the Coalition of Environmentally Responsible Economies (CERES) with the mission of designing globally applicable guidelines for preparing enterprise-level sustainability reports;
- Producing independently verified environment statements is a requirement of under the European Eco-Management and Audit Scheme (EMAS);
- The Global Responsibility Communication Platform is an Internet-based environmental reporting tool. The Platform is housed on Global Responsibility’s web site and allows free public access to information on company activities, policies, practices and performance;
- CERES 2000 Environmental Reporting Requirements;
- PERI; and,
- Sunshine Standard.

Existing Case Studies

Suggested Industry Best Practice Examples and Case Studies

Suncor
Alcan
Ontario Power Generation
VanCity
DuPont Canada
Dofasco
Shell Canada
Interface Flooring System
Noranda
Environmental Management Systems

Definition

An environmental management system (EMS) is an approach to manage an organization’s environmental issues in a systematic manner that allows for continual improvement. A number of standards have been developed for organizations implementing an EMS. In 1996, ISO published its *International Standard for Environmental Management Systems* — the ISO 14001 standard — which has become the most widely recognized and globally applicable EMS standard. The *Eco-Management and Audit Scheme* (EMAS) developed in the European Union is used primarily within Europe where the institutional framework for certification exists.

The ISO standard uses a “management by objective” approach to integrate environmental management into an organization’s operations. Seventeen elements are organized along a “Plan–Do–Check–Feedback” cycle designed to help organizations meet their environmental performance goals, comply with applicable environmental regulation, and drive continual improvement. These elements are grouped into five categories as shown in Figure 1 and described below.

**Figure 1: EMS Model from the ISO 14001 Standard**

32 The International Organization for Standardization (ISO) was established in 1947 and is a worldwide federation of national standards bodies from approximately 130 countries. Each country has its own member body, which in turn represents ISO on a national level. The Standards Council of Canada (SCC) is the national body admitted to membership of ISO.
• **Environmental Policy** — Establishes and communicates an organization’s position and commitment as it relates to the environment.

• **Planning** — Identifies environmental issues and requirements, and defines the initiatives and resources needed to achieve environmental policy and economic goals.

• **Implementation and Operations** — Describes the procedures, programs and responsibilities necessary to implement the key initiatives to achieve goals.

• **Checking and Corrective Action** — Regularly monitors and assesses the effectiveness of environmental management activities.

• **Management Review** — Provide high level evaluation of the management system as a whole to determine its overall effectiveness in terms of driving continual improvement and achieving business goals.

**How is it Used?**

Many EMS efforts begin with an examination of the existing management systems and compare them to the ISO 14001 requirements. The gaps identified in this comparison can indicate which elements/programs the organization needs to develop or improve. Often, EMS can be integrated with existing programs if the process starts from the perspective of compliance and then moves towards goals that go beyond compliance. All the components of an EMS will be applied to the specific programs designed to meet the compliance requirements already recognized by the organization (see Figure 2). In most cases, these programs also represent the best opportunities to go beyond compliance and prevent

**Figure 2: Relationship Between Environmental Program and EMS Components**
pollution. Through the application of EMS principles in these programs, the organization gains the opportunity to improve overall performance while minimizing the actual impact on the personnel responsible for managing these programs.

EMS is a proven mechanism for achieving goals in organizations that have a robust management commitment to compliance with legal regulations and to the minimization of significant environmental impacts. The US Environmental Protection Agency (EPA) has published a joint research effort with the Chemical Manufacturer’s Association showing that upwards of 70 per cent of non-compliances would have been addressed by a properly implemented EMS. The challenge is developing a system that matches a specific organization’s business needs.

Organizations can also seek to certify or register their EMS to the ISO or EMAS standards. This certification involves assessment and periodic surveillance audits by accredited registrars. If the organization’s system conforms to ISO 14001, the registrar issues a certificate of registration. Some organizations may consider certification because

- customer requirements;
- government endorsement; and/or,
- public expectations.

It is important to note that the organization’s systems is registered, not its performance, products or services.

Research, which examined more than thirty firms that had implemented an EMS, showed that the top five factors contributing to the ultimate success of the EMS were:

1. management commitment;
2. active engagement and training at all levels;
3. open communication with regulatory agencies;
4. in-depth aspects and impacts assessment; and,
5. energetic EMS champions.

**Who Uses It?**

**Industry** — Large multinational corporations, as well as small businesses, have implemented EMS. In Canada, ISO 14001 certification is the most common EMS and is most prevalent in the following sectors: chemical, automotive parts manufacturing, electronics and telecommunications, mining, metals and forestry. At the end of March 2001, 29,794 companies had been certified worldwide, with the majority in Europe (48 per cent) and Japan (20 per cent).

**Government** — Some government bodies, particularly local governments, have chosen to implement their own internal EMS. Examples of government entities that have certified EMS

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34 Reinhard Peglau, German Federal Environmental Agency, Berlin, Germany. Personal communication.
are the City of Calgary and New York City Transit Authority. Within the US, the EPA and the Pennsylvania Department of Environmental Protection have sponsored several programs to advance environmental performance improvements with local governments.

**Institutions** — Institutions such as universities are also implementing EMSs. Universities with an EMS in place include University of Missouri-Rolla, Goteborg University, University of Melbourne and University of British Columbia.

**Business Case**

The benefits that may be accrued through the use of an EMS are very specific to, and dependent on, the organization that is implementing it.

EMS offers a wide range of potential benefits. Ideally an EMS is integrated with existing operations and management systems and can help to streamline operations. It can provide a tangible connection between the goals and objectives an organization has set, and the programs and initiatives it uses to reach them. It can increase the accountability throughout the business and decrease liability. Companies have cited these business benefits:

- improve environmental performance;
- enhance compliance;
- prevent pollution and conserve resources;
- reduce/mitigate risks;
- attract new customers and markets (or at least retain access to customers and markets with EMS requirements);
- increase efficiency/reduce costs;
- enhance employee morale, enhance recruitment of new employees;
- enhance image with public, regulators, lenders, investors;
- achieve/improve employee awareness of environmental issues and responsibilities; and,
- qualify for recognition/incentive programs.

Some examples of how these benefits may be achieved are provided below.

- Development of an EMS can enhance competitive advantage. As customers are seeking ways to distinguish among suppliers, environmental performance becomes one criterion for distinguishing a company from its competitors, and an ISO 14001-based EMS is a readily identifiable indication of commitment to improved environmental performance.

- Public perception will improve as a result of development of an EMS that adheres to the most recognized international standard for environmental management.

- Development of an ISO 14001-based EMS has the potential to lessen some of the burdens imposed by regulatory requirements. First, it streamlines the processes needed to meet those requirements. Second, it provides the opportunity for regulatory agencies to
offer increased flexibility with regards to permit applications and/or enforcement activities.

- An ISO 14001-based EMS offers the opportunity to reduce costs. Increasing the efficiency of performing environmental functions (including compliance with regulations) will reduce the cost of those operations.

- An EMS becomes a tool for enhancing the value of existing assets. These assets will be viewed as more valuable if they are “protected” by an EMS that ensures commitment to compliance and minimizing pollution.

The process of putting an EMS in place may be costly, particularly if it includes certification to a standard. Certification requires significant resources in terms of money, time and effort. However, this type of management system may provide an organization with a new perspective on its approach to environmental concerns (see Figure 3). Case study literature indicates that, in most cases, the benefits justify the work of putting an EMS in place.

**Figure 3: EMS — A Different Approach**

<table>
<thead>
<tr>
<th>BEFORE</th>
<th>AFTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactionary</td>
<td>Proactive, continuous improvement</td>
</tr>
<tr>
<td>Compliance focus</td>
<td>Consideration of all environmental impacts</td>
</tr>
<tr>
<td>Separation of EHS and other processes</td>
<td>Integration of EHS and other processes</td>
</tr>
<tr>
<td>Isolated activities</td>
<td>Partnerships</td>
</tr>
<tr>
<td>Informal/undocumented procedures</td>
<td></td>
</tr>
</tbody>
</table>
IBM

All IBM manufacturing and development sites are included under the same registration certificate and all subscribe to the same EMS despite their location around the world. The EMS allows IBM to achieve continuous improvement of its environmental performance. The system is reviewed, monitored and assessed on a regular basis in order to ensure its functionality, enable performance measurements, and validate improvements. A corporate *Environmental Management Manual* is the basis of all environmental systems for each plant worldwide. Each facility must then document the operations of its local management system.

IBM Canada owns a manufacturing plant in Bromont, Quebec, located about 80 kilometers southeast of Montreal. The Bromont plant, which employs about 2,500 people, specializes in the manufacturing of various types of advanced electronic components that are then exported to customers worldwide. IBM-Bromont uses a wide range of chemical products in its manufacturing activities and has its own wastewater treatment plant, a facility specialized for the storage of chemical products and equipped with a series of dump tanks. Effluents and emissions are monitored and reduced and the plant is certified to ISO 14001 since 1998.

There are processes in place for defining significant aspects, establishing targets for continuous improvement and auditing. There are also core performance indicators used at the plant (corporate and local follow-up of performance). Nine significant aspects have been identified at the Bromont plant — air emissions, discharges, water use, energy use, liquid effluents, hazardous waste, solid waste, chemical products use and underground water. IBM-Bromont has realized many environmental and operational benefits through continuous improvement in environmental performance.

Source: Building Sustainable Enterprises. Industry Canada.
http://strategis.ic.gc.ca/epic/internet/inbseced.nsf/vwGeneratedInterE/bi00052e.html#IBM
Trends and Future Importance

In Canada, there were 801 ISO 14001 certified organizations at the end of 2001, up from 475 at the end of 2000. Increasingly, regulators are requiring organizations to undertake EMS to ensure regulatory compliance or as a mitigative measure following an environmental violation. In some sectors, EMS or ISO 14001 specifically, has become an industry standard due to requirements handed down by customers. The most obvious example is the prerequisite imposed by original equipment manufacturers in the auto industry (e.g., Ford, DaimlerChrysler and General Motors) on their suppliers (auto parts manufacturers) that they must institute ISO 14001. EMS continues to gain recognition among industry and government as an effective method for dealing with the full spectrum of environmental issues that organizations face.

Related Legislation and Regulations

In some jurisdictions, regulators are requiring certification to an international standard such as ISO 14001 before they will issue operating permits. In the UK North Sea, for example, the UK Offshore Operators Association (UKOOA) has stated that the industry standard in this area will require all oil and gas producers to have produced, by the end of 2002, an independently verified EMS for each installation as a condition to operate in the region.

In the US, requirements to implement an EMS are becoming more common in the settlement of suits involving environmental violations. Also, the US Federal Government has an Executive Order 13148 (Greening the Government Through Leadership in Environmental Management) which requires that by April 2002, each Federal agency must implement environmental management systems (EMS) pilot projects at selected facilities and by December 31, 2005, implement EMSs at all appropriate agency facilities.

Linkages to Other Tools

Life Cycle Assessment — Determining the aspects and impacts of products.

Pollution Prevention — Activities can help an organization to reach goals.

Key References


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Existing Case Study Sources

TRST.com Case Studies
BSi Management Systems Case Studies
Environmental Management System Case Study: Federal Foam Technologies, Inc.

Possible Sources of Case Studies

Siemens
Kuntz Electroplating Inc.
Black & Decker
Shell
Ontario Power Generation
Alcan
Environmental Labelling

Definition

Environmental labelling includes a number of activities, ranging from business-to-business transfers of product specific environmental information to environmental labelling in retail marketing. The overall goal of environmental labelling (or eco-labelling) is to encourage the demand for, and supply of, those products and services that are environmentally preferable through the provision of verifiable, accurate and non-deceptive information on environmental features of products and services.

How is it Used?

The international community has developed a set of standards for environmental labelling. These ISO standards define three types of environmental labels.

Type I or “seal of approval” labels are awarded to products by a third party — either government or private. Products meeting a set of predetermined criteria earn the label. Criteria are established for distinct product categories by the labelling body and deal with multiple environmental aspects of the product. These labels are sometimes directed at specific types of products, such as the Environmental Choice label for paints and surface coatings, or Energy Star for lighting and appliances. These labels indicate that a product is environmentally preferable, in order to increase the demand for environmentally preferable products. These labels are usually represented by a logo on the product or product packaging.

Type II or “self-declaration” labels are based on a manufacturer’s self-declared claim about a product’s environmental performance. These labels typically deal with one or more environmental aspects of the product (e.g., recycled material content). The requirements of the ISO international standard on Type II labels apply to information beyond what is indicated on a product and includes information that is conveyed by other means, such as TV, radio and print advertising. Like Type I labels, it is expected that Type II labels inform the public and help raise the demand for products that are less environmentally damaging.

Type III “environmental product declarations” provide environmental data about a product. These declarations are produced by the company making the product or service, and are often certified by a third party. They usually take the form of brochures, rather than a simple label

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36 www.environmentalchoice.ca.
37 www.energystar.gov.
or logo. The declaration is typically based on a life cycle study, as required by the ISO technical report for Type III declarations. The declaration contains quantified data from various life cycle stages of the product, including: material acquisition, manufacturing, transportation, use and end-of-life disposal or recycling. The declaration may also contain qualitative data about the product and the company. Type III declarations allow consumers to compare products based on all of their environmental impacts and make their own decision about which product is preferable. Competition on environmental grounds is invited by this kind of declaration. Examples include declarations from Sweden’s Environmental Product Declarations (EPDs) Program.39

Figure 1: Type I Environmental Labels from Around the World

Who Uses It?

Industry — Environmental labelling is employed by companies in a variety of ways to communicate environmental information about their products. Active industry sectors include; forest products (wood and paper), consumer durables, electronics, paints, energy, textiles, food, as well as some services (e.g., hotels and golf courses).

Government — Governments in many countries administer national product labelling and declaration programs; in some cases these programs are administered by private organizations. The Global Eco-labelling Network (GEN) currently has 26 member countries. The same is true for environmental product declarations.

Associations and NGOs — Administer some specialized labelling programs (e.g., Forestry Stewardship Council certified wood products).\textsuperscript{40}

Business Case

The effectiveness of environmental labels is difficult to measure. However, it is generally agreed that organizations adopt eco-labelling of their products to gain market access and competitiveness. Improved brand and corporate image are secondary benefits. Type I labels, such as the Environmental Choice Program (Canada) and Energy Star (US), have had significant effects in influencing the marketplace, particularly in consumer products, homes and buildings. In Sweden, the national environmental label has significantly influenced the market for detergents and paper products.\textsuperscript{41}

Type II labels can be very useful to consumers who are looking for certain environmental qualities in a product (e.g., recycled content). However, if the label is not ISO conformant it may be confusing or misleading.

Type III labels are a more recent development and the effects are hard to judge. It does appear that there is greater potential for Type III label use in company-to-company selling for some products. These labels may offer more detail than the consumer requires, but a purchaser for a company buying in bulk may wish to consider all the environmental impacts of the product. For major purchases, such as cars, appliances and electronics, a product declaration may be appropriate for the consumer. There is also potential to use declarations to communicate DfE progress inside and outside organizations.

\textsuperscript{40} www.fscoax.org.
\textsuperscript{41} Ecolabelling: Actual Effects of Selected Programmes. OECD. 1997. www.olis.oecd.org/olis/1997doc.nsf/a0c602508a90ce004125669e003b5adf/eb26d6cf94b50cd1c1256a5005299e0/$FILE/06E71962.ENG.
Marine Stewardship Council’s Ecolabeling of Seafood

The world catch of wild fish for human consumption increased from 20 to 95 million tons between 1950 and 2000. As a result, there is an increasing demand to exploit known fish stocks as well as find and develop new stocks. However, it is generally agreed that fish stocks worldwide have declined in the past several decades.

In response to these pressures, the World Wildlife Fund (WWF) teamed up with Unilever, the multinational corporation, to create the Marine Stewardship Council (MSC) in 1997 (which then became independent in 1999). The MSC has developed a logo to tell consumers that their purchase supports well-managed and sustainable fisheries and has not contributed to the environmental problem of overfishing. Seven fisheries have been certified worldwide since 2000 and there are now 131 MSC-labelled product lines on sale in 10 countries.

Although the MSC certification program is relatively young (2000), distributors, supermarkets and producers have realized some initial benefits. Some of the largest supermarket corporations around the world are supporting the MSC program (including Whole Foods Market, Delhaize, Tesco and Sainsburys), carry MSC-labelled product in their stores and do major promotions of these seafood products. The foodservice sector has also begun adopting MSC-labelled seafood products. The Unilever Corporation is involved in selling MSC-labelled seafood (through its Iglo and Birds Eye brands).

Trends and Future Importance

Type I environmental labelling programs are growing in number, and many existing programs are expanding to include more products and services. The Global Eco-labelling Network (GEN) currently has 26 member countries. Type I labels have been created in emerging economies, such as the Czech Republic, Croatia and India. Most recently, Australia joined GEN and initiated a national labelling program. Some of the parties are establishing mutual recognition agreements, in the hope of harmonizing the programs to some degree.
Type III labels are experiencing a great deal of growth. The current ISO document on Type III labels is a technical report; however, the decision has been taken to develop it into a standard. ISO is also developing a standard for Type III labels for the construction sector, which is one of the fastest growing in terms of product declarations. Global Type III Environmental Declaration Network, an international organization of bodies that are implementing Type III labels, is planning to expand and to include research organizations.

The European Commission is interested in the possibility of using environmental product declarations (Type III) for public procurement. An important obstacle is the scarcity of published product declarations allowing for fair comparisons. In Sweden, where there are more declarations on the market, and where the government approves of EPDs, they are being used for educating procurers: EPDs can provide the background for writing a tender, or for developing criteria to assess proposals.

There has been a judicial decision taken by the EU court, as well as an accompanying official EU interpretative document arising from a decision in Finland to choose a bus type for a public transportation system for its environmental performance over a less expensive competitor. The interpretative text points out that, among other aspects, environmental labels may be considered for procurement. In addition, life cycle analyses may be used for procurement decisions, as long as the production characteristics contribute to the actual environmental performance of the product (e.g., an energy efficient car may be considered, but not its energy efficient production).

Related Legislation and Regulations

Environmental labels are voluntary, and as such there are no laws dictating their use. However, many organizations, public and private have put in place Green Procurement programs that specify the purchasing of eco-labelled products.

Linkages to Other Tools

**Life Cycle Assessment/Management** — Type III labels are required by ISO to be based on a life cycle study, and Type I labels are expected to have requirements that consider environmental impacts throughout the life cycle of the product or service.

**Design for Environment** — A Type I or Type II label may be achieved as the result of DfE activities, or Type I requirements may be used to guide DfE activities. Type III declarations can be useful to document environmental improvement in different product development stages or different product variants.

**Green Procurement** — Environmental labels and declarations are used as criteria in environmental purchasing policies.

**Integrated Product Policy** — Environmental product information is seen as a key instrument for stimulating awareness and demand for green products.
Key References


Existing Case Study Sources

Green Product Project — Case Studies
International Institute for Sustainable Development — Compendium of Instruments
Finnish Technical Assistance to Environmental Labelling for Export Industries in Nepal 1999–2002
Nordic Swan Ecolabel for Scandic Hotel Continental, Stockholm
Evaluation of Environmental Product Declaration Schemes
Environmental Labelling of Electricity: Label Design and Performance

Possible Sources of Case Studies

Germany’s Blue Angel
Development of Type III labels in Canada
Swedish EPDs
Vattenfall
ABB
Electrolux
Bombardier
Environmental Impact Assessment

Definition

Environmental impact assessment (EIA) is the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. In Canada, EIA is applied to development proposals or projects as defined under the Canadian Environmental Assessment Act (CEAA). A related methodology, strategic environmental assessment, is applied to policies, programs and plans. It is generally recognized that both processes are important and should operate in a complementary fashion. EIA is frequently described as a planning tool that contributes to sustainable development. This is one of the purposes stated in the CEAA.

How is it Used?

Environmental Impact Assessment is a decision making process for reducing impacts on the environment resulting from human activities. This is implemented by making changes to project or activity plans, or if necessary by preventing a project from going ahead at all. EIA is employed when new buildings or structures are planned, such as bridges, or new activities planned, such as raw materials extraction.

EIA is a legislated element of the project development process in many countries. The project proponents must provide information about the project’s environmental, social and economic impacts prior to execution. This information is submitted to a panel that decides how the project will proceed, if at all.

EIA processes in different jurisdictions vary in terms of the types of projects to which they apply and whether the assessment must consider effects of all phases of the project life cycle or just the construction phase. There is also variation in the scope of factors (environmental, social, economic) that are considered. Although it varies, there are several steps that are common to most EIA procedures.

- **Screening** — It is decided whether an EIA is needed.
- **Scoping** — It is determined what the concerns are, who is involved and what information is required from the project proponent.
- **Environmental Studies** — The project proponent:
  - determines baseline environmental conditions (through desktop research, field surveys, etc.);
  - predicts how baseline conditions would be expected to change over time as a result of impacts from the project in comparison to impacts that would be expected from alternatives to the preferred proposal;

42 IAIA and IEA. *Principles of Environmental Impact Assessment Best Practice*. [www.iaia.org](http://www.iaia.org)
Environmental Concepts and Tools

Environmental Impact Statement — The project proponent submits all of the information on environmental, social and economic impacts to the competent authority; usually this document or set of documents is called the Environmental Impact Statement.

Consultations with Stakeholders — The environmental impact information is made available to the public and feedback is received.

Decision of the Competent Authority — The competent authority may decide that the project can go ahead as planned, that it cannot go ahead, or that it can go ahead with specified changes that will mitigate the project’s impact on the environment or compensate for those impacts.

Post-project Approval — This encompasses actions that may occur once a project receives EIA approval, such as compliance monitoring to see if the project has been implemented in accordance with the approved terms and conditions, follow-up studies to evaluate the accuracy of predictions and the effectiveness of mitigation measures, other studies to fill in gaps in the assessment, establishment of stakeholder advisory groups, etc.

In a few cases, projects go to an environmental assessment panel for consideration. In recent years, only a handful of the more than 5,000 projects assessed under CEAA have undergone panel review.

Who Uses It?

Industry — Industry typically conducts formal environmental impact assessments when required by regulation. However, a number of leading companies integrate environmental assessment procedures into their risk management processes when evaluating large scale projects/investments.

Government — EIA is used internally by governments to determine the impacts of government and government sponsored projects and, in some cases, is imposed externally on private sector projects.

Institutions — Organizations, such as the World Bank and the insurance industry, also use EIA to determine the effects of projects they may fund or insure.

Business Case

The EIA process is sometimes seen as adversarial by industry. This may be due to fears that:

• the cost of conducting an EIA can add to the overall development costs;
• the EIA approval may be delayed, further increasing uncertainty and costs; and,
• government authorities may require changes to the development proposal based on the EIA findings.
However, the EIA can be a positive experience for the project proponents and the stakeholders affected by the project. The investigations that are required for the EIA may bring up new information that was not previously considered. In cases where mitigations of environmental impacts are required, the changes to the project can lead to innovations that reduce environmental impact and costs at the same time.

NWT Diamonds Project

In December 1994, a federal environmental assessment panel was appointed to review the environmental and socio-economic effects of the NWT Diamonds Project proposed by BHP Diamonds Inc. and the Blackwater Group (BHP). The proposal involved open-pit and underground mining of five diamond-bearing deposits located about 300 kilometres northeast of Yellowknife near Lac de Gras.

The panel held scoping meetings to identify issues of concern in March and April 1995, and public hearings in January and February 1996. Scoping meetings and public hearings were held in a total of 10 Northwest Territories (NWT) communities likely to be affected by the project. All written and oral information received by the panel was considered in the panel report.

The panel report addresses the acceptability of the project based on its environmental and socio-economic effects in the NWT. Some of the panel’s recommendations concerning environmental impacts were:

- continual revision and updating of environmental management plans;
- implementation of a fuel spill contingency plan;
- monitoring of air quality;
- consideration of water quality be considered in the permitting process; and
- actions with regard to fish, birds, caribou and grizzly bears.

The panel concluded that the environmental effects of the project are largely predictable and can be mitigated. Effects not predicted can be detected by monitoring and can be addressed by the proponent's proposed environmental management plans and adaptive management strategy. The potential economic benefits from this project are large, and socio-cultural effects are likely to be both positive and negative but are difficult to predict on balance. It is expected that adverse social effects can be addressed by policies and programs of governments and the proponent. Overall, the panel concluded that the project has the potential to provide significant benefits to the North and northerners. The panel recommended that the Government of Canada approve the NWT Diamonds Project subject to its recommendations.
Trends and Future Importance

Several aspects of EIA have become more important recently.

- **Public Involvement** — There is increasing recognition of the importance of involving all stakeholders, both experts and the general public, in the EIA process to ensure that all perspectives are taken into account.
- **Cumulative Effects** — Whereas in the past, EIAs have tended to focus on the effects of a particular development in isolation, there is a growing recognition of the need to look at how these effects, in combination with those of other past, present and future projects, will impact on the environment.
- **Strategic Environmental Assessment** — This concept is continuing to spread with the growing recognition that project level EIA may not enable interventions at an early enough stage to effect meaningful change. Assessing the environmental implications of government/corporate policies, programs and plans is meant to redress this shortcoming.

Related Legislation and Regulations

Canadian Environmental Assessment Act and Regulations
US National Environmental Protection Act
EU Environmental Impact Assessment Directive

Linkages to Other Tools

**Environmental Risk Assessment** — A similar approach that evaluates risks rather than actual expected outcomes.

Key References

Canadian Environmental Assessment Agency (CEAA)
International Association for Impact Assessment
Environmental Impact Assessment Review
EU Environmental Assessment

Existing Case Study Sources

CEAA Cumulative Effects Assessment Case Studies
International Study of the Effectiveness of Environmental Assessment Case Studies
Air Pollution and Environmental Impact Assessment Case Studies
Billund Airport EIA
Sakhalin II Project
Public Involvement in Environmental Impact Assessment
PENELOPE Case Studies
Possible Sources of Case Studies

Canada — Index of Completed Comprehensive Studies
Australia — Major Commonwealth Assessments under EPBC and EPIP Acts
Netherlands — Commission for Environmental Impact Assessment
Ecological Footprint

Definition

The ecological footprint is an accounting tool for ecological resources. Categories of human consumption are translated into areas of productive land required to provide resources and assimilate waste products. The ecological footprint is expressed in “global hectares.” Each unit corresponds to one acre of biologically productive space with “world average” productivity. Ecological footprint can be summarized as a measure of the sustainability of our lifestyles.  

How is it Used?

The ecological footprint provides a comprehensive comparison of natural resources demand and supply availability. The ecological footprint analysis compares the actual geographic area or footprint of a region (e.g., city, country, etc.) with the virtual footprint that would be required for that region to be sustainable. Reese & Wackernackel, the originators of the concept, estimate that the residents of the Earth are currently consuming resources at a rate that would require four times Earth’s resources in order to be sustainable. The analysis is primarily based on data published by United Nations agencies and the Intergovernmental Panel on Climate Change. In summary, ecological footprint can be used as a measure, or indicator, of progress towards sustainability, rather than a tool to improve the environmental performance of an organization. The data resulting from such measurement can be used for communication purposes both internally and external to an organization (see City of Toronto example).

Who Uses It?

Industry — Ecological footprint calculations are typically applied to communities as opposed to industrial operations; however, the quantifiable nature of the concept is applicable to private industry and could be used as an evaluative tool. Industry would benefit from an understanding of the implications of corporate decisions relevant to the ecological footprint. Such a measurement may stimulate the emphasis on environmental initiatives to reduce an individual company’s ecological footprint.

Government — The United Nations calculates the ecological footprint for nations. National consumption is calculated as domestic production plus imports minus exports. This balance is computed for 72 categories such as cereals, timber, fishmeal, coal and cotton. Some examples of ecological footprints (in global hectares) are as follows:

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Ecological Footprint of Nations

<table>
<thead>
<tr>
<th>Country</th>
<th>Global Hectares per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>10.3</td>
</tr>
<tr>
<td>Canada</td>
<td>7.7</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.9</td>
</tr>
<tr>
<td>India</td>
<td>0.8</td>
</tr>
<tr>
<td>Global Average</td>
<td>2.8</td>
</tr>
</tbody>
</table>

**Organizations** — Local interest groups, NGOs and environmental organizations use the calculated ecological footprint to define issues of concern and reinforce the need for environmental and sustainability initiatives in developed countries. Numerous web sites and resources allow crude personal ecological footprint calculations to emphasize the environmental consequences of the modern Western lifestyle.

**Individuals** — A person’s ecological footprint can be computed using a “top-down approach,” by dividing the regional or national total consumption by its population size. The footprint can also be determined using a “bottom-up approach,” by estimating the footprint of individuals, households or communities from the results of a lifestyle questionnaire. The latter is an example of direct measurement.

**Business Case**

The ecological footprint is an indicator of sustainability and risk, globally and locally. It shows where humanity needs to improve and where innovation will be required. This can be of strategic value for businesses thinking about the next generation of their technology and service innovations. In this way industry can use systems knowledge to evaluate risks and economic success much like the principles of backcasting advocated by The Natural Step pedagogy, which opens new opportunities for business development by adding value through sustainability. In this way businesses can secure their economic success and become leaders for sustainable development.

Mathis Wackernagel and contributors have defined the business benefits of the Ecological Footprint.

**Competitive Advantage** — Biophysical assessments are critical to making businesses become more competitive. In a time when products and their prices are becoming increasingly similar, product sustainability may determine the competitive advantage on the market. Among comparable products, the modern consumer will pick the more sustainable choice. Also for companies, sustainable production will reduce long-term costs and exposure to risks like pollution damage or resource exhaustion. Footprint based eco-labels could be an

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effective strategy to differentiate products. The companies introducing them first will achieve their product differentiation cheaper and more effectively than the followers.

**Business as Leaders for Sustainable Development** — With hardly any exception, conventional corporate greening and “environmental responsibility” have side-stepped measurable and meaningful improvements toward sustainability. To date no business has established a basis for assessing sustainability and declared its performance. Their indices, measures, conventions or codes of conduct have served only to increase the noise and obscure the signal. The result is crushed public confidence and little action. However, sustainable behaviour can be business driven if appropriate measures and ethics are applied. In fact, it can create a potential renaissance for business. Activities of benefit to the environment generally have lower social costs, which eventually pay back for the company, its shareholders and society. These advantages of environmental leadership have been well elaborated by organizations like The Natural Step.

**Wasting Waste** — Tools like the ecological footprint to assess resource inputs and waste discharges can become valuable tools for managers to analyze business operations and technologies. Knowing in physical terms what enters and what leaves a business and its production processes helps detect unnecessary costs and untapped opportunities. It points to waste that could become a resource and to resources that are squandered. It also assists the planning of ecologically sounder production and business operations.
The Ecological Footprint Questionnaire Pilot Study was developed by the Environmental Division of the former City Works Services (now Works and Emergency Services) to test how effective the ecological footprint concept is at educating the residents of Toronto about the environmental impact of individual consumption. A questionnaire was designed and a method of calculating a participant's ecological footprint was developed to use the information provided from the survey. The questionnaire was introduced in the fall 1997 issue of Waste Talk (newsletter produced by the former City Works Services) and distributed to over 200,000 households during the second and third weeks of October 1997. To date, this article has generated 345 inquiries to which 261 questionnaires have been sent out. Of the 261 questionnaires, 156 were completed and ecological footprints were calculated from the information provided.

The ecological footprint of the "average" respondent was 4.94 ± 2.00 hectares, which is 31 per cent smaller than the Canadian average. The appropriated carrying capacity, or the land needed to support the 156 respondents, is 770.64 hectares or 7.71 km². Thus, the amount of land needed for all of Toronto's residents, if the "average" participant from this pilot study sample is the "average" Torontonian, is 11,783,983 hectares or 117,840 km². In other words, if the area of Toronto is 630 km², the amount of land that its residents appropriate is approximately 187 times larger than its geographic size.

The results of the pilot study show that people are interested in learning more about the environment and the impact their various lifestyles have. The ecological footprint is an excellent method of educating people. It is not only effective at quantifying this impact, but is also a powerful tool that presents this information through an illustration. To manage over-consumptive behaviour, we must first take a "snapshot" of where we are now, identify the activities that can be reduced, implement techniques that lower resource use in these targeted areas, and then re-calculate and reduce the size of our ecological footprint.
Trends and Future Importance

The results of a pilot study to measure the ecological footprint of Toronto show that the public is interested in the environment and how their choices impact the world. The ecological footprint is a tool for quantifying the sustainability of our behaviour. This type of measurable approach helps government understand the direct cause effect of our actions on the environment.

Environmental groups as well as governments recognize that to manage our environmental impacts, we require an understanding of where we are now and how to measure improvement. The ecological footprint allows government to target activities and sectors for legislation towards reducing their footprint.

Related Legislation and Regulations

Not currently a regulated environmental assessment concept. The quantitative nature of the ecological footprint does, however, make it a potentially applicable concept when developing new regulatory frameworks.

Linkages to Other Tools

Environmental Impact Assessment (EIA) — EIA is an approach to assess potential impacts of a planned project, activity or process. This compares to ecological footprint’s use as an estimating tool for resource use of an organization, activity, etc.

Key References

Mathis Wackernagel, Coordinator of the Centro de Estudios para la Sustentabilidad at the Universidad Anáhuac de Xalapa in Mexico and Director of the Indicators Program at Redefining Progress based in San Francisco, US. He has a Ph.D. in community and regional planning from the University of British Columbia in Canada and a mechanical engineering degree from the Swiss Federal Institute of Technology. www.ecouncil.ac.cr/rio/focus/report/english/footprint.


Redefining Progress is a nonprofit, nonpartisan public policy organization that seeks to ensure a more sustainable and socially equitable world for our children and our children's children. The web site had detailed information on the Ecological Footprint. www.rprogress.org/programs/sustainability/ef.
Existing Case Studies

Unknown.

Suggested Industry Best Practice Examples and Case Studies

Unknown.
Eco-efficiency

Definition

Eco-efficiency can be broadly defined as the production, delivery, and use of competitively priced goods and services, coupled with the achievement of environmental and social goals. Inherent in the concept of eco-efficiency is a strong linkage between environmental performance and shareholder value, a broadening of environmental management to focus on products (in addition to facilities and substances), and the consideration of the full life cycle or complete product system (raw materials, manufacturing, use, and end-of-life) when identifying improvement opportunities.

The World Business Council for Sustainable Development (WBCSD) coined the term eco-efficiency, and defined it as, “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.”

It is important to recognize that eco-efficiency only includes two of the three components of sustainable development: it brings together environment and economy, but does not deal with social issues. It is also important to consider that gains in efficiency may be accompanied by increases in production, deepening the environmental footprint of the activity. It is important to consider absolute impacts.

How is it Used?

The WBCSD has laid out seven elements that lead to improved eco-efficiency:
- reducing material requirements (e.g., light weighting of vehicle components);
- reducing energy intensity (e.g., lower standby power drain in electronic products);
- reducing toxic dispersion (e.g., eliminate bromated flame retardants in computer housings);
- enhancing material recyclability (e.g., food packaging using single polymer plastic);
- sustainable use of renewable resources (e.g., sisal flooring);
- extending product durability (e.g., computers that are upgradeable); and,
- increasing the service intensity of goods and services (e.g., car leasing).

Each of these elements provides opportunities to decrease environmental impact, while at the same time offers advantages for business.

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49 Eco-efficiency: Creating more value with less impact. WBCSD, 2000.
In 2001, the Government of Canada undertook a study to examine the drivers and challenges that organizations face as they shift toward more eco-efficient operations, products and services. The industrial case studies included in the study indicated that the practice of eco-efficiency ranges 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.\(^{50}\)

**Who Uses It?**

**Industry** — Eco-efficiency has been explicitly adopted by a number of large companies operating in several sectors, including electronics, chemical, metals and mining and forestry. Companies that publicly utilize the term include BASF, 3M, Dow and Baxter International, among others. Some small and medium sized enterprises are starting to recognize the cost saving opportunities available through eco-efficiency and are implementing material and energy use reduction programs.

**Government** — Governments are promoting eco-efficiency as an option for reducing environmental impact while increasing productivity. In Canada, the National Round Table on the Environment and the Economy, Industry Canada and Natural Resources Canada have all promoted the concept and sponsored the development of research and/or tools to promote eco-efficiency. The European Commission and the European Environment Agency have also promoted eco-efficiency. Multi-lateral organizations, such as UNEP and the OECD, also promote eco-efficiency. And organizations, such as the World Bank’s International Finance Corporation, are looking at how it can integrate the concept into their project processing cycle.\(^{51}\)

**Business Case**

Eco-efficiency was initially intended to be the business community’s response to sustainable development. It contends that improving environmental performance does not have to be a cost to industry, but can be a source of savings. It appeals to business as a practical “win-win” approach to improving environmental performance. The three key goals of eco-efficiency are:

- increase product or service value;
- optimize the material and energy intensity of products; and,
- decrease environmental impacts.

Many organizations have identified various benefits beyond cost savings:

- Pursuing eco-efficiency can spur innovation in a company; finding methods to conduct business more efficiently can lead to new ideas.

\(^{50}\) *The Role of Eco-Efficiency: Global Challenges and Opportunities in the 21st Century*. June, 2001. PRI Research Study

\(^{51}\) [www.ifc.org/enviro/EFG/Eco-eff/eco-eff.htm](http://www.ifc.org/enviro/EFG/Eco-eff/eco-eff.htm)
• Reducing or eliminating toxic materials can greatly decrease the risk and liability to which a company is exposed.
• Overall improvement in environmental performance can result in fewer compliance issues and increase positive recognition (such as awards).
• Acting positively for the environment can boost employee morale.
• More efficiently produced (and thus more competitively priced) goods can increase revenue.

Table 1 below summarizes the business benefits identified by companies who participated in the 2001 Policy Research Initiative Eco-efficiency study.

Table 1: Benefits of Eco-efficiency as Identified in Canadian Government Study (2001)

<table>
<thead>
<tr>
<th>BENEFITS</th>
<th>BASF</th>
<th>Shell</th>
<th>Compaq</th>
<th>Daimler-Chrysler</th>
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BASF
Source: www.basf.de/en/corporate/sustainability/oekoeffizienz

BASF utilizes an eco-efficiency analysis tool that enables it to evaluate environmental and economic implications of new and existing technologies and products. The analysis includes consideration of environmental impacts in all stages of the life cycle, and the total cost of the product or process. The results are used for product and operational improvements, and for environmental marketing.

The environmental impact of a product or process is measured according to five factors: emissions (to air, water and land), toxicity potential, material consumption, energy consumption, and risk potential. Economic data are also gathered to cover the entire life of the product. This includes costs incurred in the processing of the raw materials and the manufacturing of the product itself, and in its transportation, use and disposal. The economic evaluation and the environmental results are combined to create the eco-efficiency analysis (Figure 1). The analysis plots the normalized cost on the x-axis and the normalized environmental burdens on the y-axis.

To date, BASF has conducted eco-efficiency analyses on approximately 100 product applications. This tool was used to assess the indigo dyeing process, to determine which method was the most cost efficient, and the least environmentally damaging. The tool was also used to compare methods for preserving cereal crops, and the results confirmed that the current use of propionic acid was the most cost efficient and least damaging. The tool also allowed BASF to document the benefits of an innovative asphalt micro-resurfacing technology. The analysis revealed the following benefits: a reduction in energy used, a reduction in emissions, reduced labour requirements which translated into lower costs, and a lower cost per mile of asphalt applied using the new technology as compared with the traditional method.
Trends and Future Importance

Eco-efficiency is a popular approach for identifying cost savings in industry. It gives small companies an opportunity to take action on environmental issues while securing an immediate financial benefit, which is not always available through other approaches, such as Environmental Management Systems. However, some companies are now moving beyond eco-efficiency to concepts such as corporate social responsibility (CSR), which considers all three aspects of sustainable development: economic, environmental and social value. Some visionaries argue that eco-effectiveness (more ecologically intelligent design of facilities and products) rather than eco-efficiency is a more useful concept for sustainability. Eco-efficiency is a bridge concept that enables individuals to see the potential benefits of advanced environmental management and, in some cases, this can lead to exploration of other concepts and tools.

Related Legislation and Regulations

There are no regulations requiring the implementation of eco-efficiency in industry. However, some jurisdictions are promoting the adoption of eco-efficiency on a voluntary basis. The Australian government has established three-year voluntary agreements with industry associations, wherein they both assist association members in implementing eco-efficiency. Industry Canada and other government departments have been promoting the concept through speeches, presentations, publications and websites (see Industry Canada Eco-efficiency website below in key references). Eco-efficiency has also gained government support in the European Community as well as in other countries.

Linkages to Other tools

Factor 10 — An approach wherein industry would aim to increase their resource productivity by ten-fold in order to reach sustainability. An efficiency increase of a factor of four is seen as a short-term goal, with a factor of 10 considered a long term goal.

Life Cycle Assessment, Design for Environment and Environmental Management Systems are all tools available to help industry become more eco-efficient.

Key References

World Business Council for Sustainable Development
Industry Canada’s Eco-efficiency Site
National Round Table on the Environment and the Economy Eco-efficiency Indicators

Existing Case Study Sources

WBCSD Eco-efficiency Case Studies
Environment Australia Eco-efficiency and Cleaner Production Case Studies
Industry Canada Eco-efficiency Case Studies
The Role of Eco-Efficiency: Global Challenges and Opportunities in the 21st Century

Possible Sources of Case Studies

Eco-Efficiency Centre, Burnside, Nova Scotia
Siemens
Canfor
Rohm & Haas
BASF
Canfor
Millar Western Forest Products Company
J.S. McMillan
Precautionary Principle

Definition

The 1992 United Nations Conference on the Environment and Development defined the precautionary principle in the statement, “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”  

The Wingspread 1998 conference of activists, scholars, scientists, and lawyers released an alternative definition stating, “When an activity raises threats of harm to human health, or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”

How is it Used?

The precautionary principle is applied at the management level. A precautionary approach is taken as a guiding principle when decisions are made in the face of uncertainty as to the associated environment and human health implications.

Precaution is a guiding principle that can be used to stop environmental degradation. Government through the application of guiding principles and legislation, and industry through the adoption of precautionary management practices can apply precaution. A precautionary approach includes components such as:

- setting goals;
- seeking out and evaluating alternative actions;
- recognizing the burden of proof on demonstrating an activity will not cause harm; and,
- inclusive decision making criteria.

The precautionary principle involves a new decision process weighing scientific and other evidence in the face of uncertainty. This precautionary decision-flow, addresses both new and existing activities. Operating under the precautionary principle, proponents of an activity must demonstrate that the activity will not be harmful and also have considered a wide range of alternatives, including forgoing the questionable activity. This decision process provides a consistent basis to define, examine, and identify alternatives to threats to the environment. A stepwise process is used to first characterize and understand the issue, define what is and is not known, identify alternatives, determine a course of action, and monitor the execution.

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54 Ibid.
An underlying theme of the principle is that decision-making in the face of extreme uncertainty and ignorance is a matter of policy and political considerations. Scientific evidence can inform the process but sound science cannot resolve difficult issues itself. Thus, a decision to further study or not to do anything in the face of uncertainty is a policy decision not a scientific one. A precautionary approach to environmental decision-making may include:

- Precaution in the face of scientific uncertainty — Taking responsibility to prevent the risk of environmental harm in the absence of specific laws or hazards.
- Foresight — Planning and goal setting to reduce potential for environmental harm instead of calculated risk-taking.
- Seeking alternatives — Looking for cost-effective options to reduce or eliminate all risk (i.e., use of toxic chemicals) instead of establishing hazard management and incident response plans.
- Burdens of proof — All activities must be considered potentially harmful unless proven safe. As opposed to addressing only those activities proven harmful.

Applying the precautionary approach is complicated by the inherent dynamics of science. Even though scientific information may be inconclusive, decisions will still have to be made because society expects risks to be addressed and living standards maintained.

**Who Uses It?**

**Government** — National governments use the precautionary principle to direct departmental policies and as a basis for international agreements on environmental protection. The Canadian Environmental Protection Act includes instruction for the National Advisory Committee to use the precautionary principle when issuing recommendations.

The principle has become a general principle of international treaties, conventions, agreements and national strategies for sustainable development, including the United Nations’ Framework Convention on Climate Change (1992) and the Convention of Biological Diversity (2000).

The Precautionary Principle finds its practical implementation as a concept in a series of legal actions, such as new chemicals registration.

**Industry** — The precautionary principle is best used at the design stage of any potentially hazardous activity or operation. Industrial application exists along a spectrum of precautionary actions from studying a problem to prohibiting or phasing out specific activities. In some cases, business decisions are made to discontinue a product line or cancel a planned activity because of uncertain environmental or health and safety risks. This was the

case with 3M’s decision to voluntarily pull the Scotchguard product due to environmental concerns.

**Business Case**

Organizations are encouraged to take preventive actions at the design stage of any potentially hazardous activity. Several precautionary approaches are well established: 57

- **Bans and phase-outs** — Approximately 80 countries ban the production or use of some toxic substances, such as mercury.
- **Clean production and pollution prevention** — Source reductions, material selection, product design and energy consumption are environmental strategies growing in importance due in part by the adoption of a precautionary approach to manufacturing.
- **Reverse onus chemical listing** — Proposals in Denmark and the US have been put forward to drive the development of information on chemicals and their effects. In Denmark, one proposal would require a chemical to be considered the most toxic in its class if full information on its toxicity was not available. A US proposal would require that all chemicals produced in high volume, for which basic toxicity information did not exist, would be added to the toxics-release inventory for emissions and waste reporting.
- **Organic agriculture** — The US Department of Agriculture is considering using the precautionary principle as a rule for deciding whether new technologies and substances may be permitted in organic agriculture.
- **Pre-market or pre-activity testing requirements** — The US Federal Food and Drug Act requires that all new pharmaceuticals be tested for safety and efficacy before entering the market. This model could be applied to industrial chemicals and other activities.

These and other drivers emphasize the business value in adopting a Precautionary Approach. Business benefit in the form of reduced cost and risk avoidance are immediate. Competitive advantages will continue to grow as manufacturers are pressured by consumers and legislation to reduce environmental impacts.

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The Great Lakes International Joint Commission

Perhaps the most noteworthy application of the precautionary principle is in the Great Lakes Region. The Great Lakes have been threatened for years by the emission of persistent organic compounds into their waters. In the late 1970s, the United States and Canada signed the Great Lakes Water Quality Agreement (GLWQA), which establishes the goal of virtually eliminating discharges of persistent compounds from the Great Lakes. Under the GLWQA, the International Joint Commission (IJC), a 100-year-old bi-national body established to protect waters along the border, was designated to conduct research and issue statements on the quality of the lakes and threats to that quality.

In its Sixth Biennial Report on Great Lakes Water Quality (1992) the IJC noted the damage caused by persistent and bioaccumulative substances in the Great Lakes Basin and the critical need to address those. They also recognized that attempts to manage such chemicals, based on the notion of assimilative capacity in the environment, had failed miserably. The Commission issued a call to phase out all persistent toxic substances in the Great Lakes Ecosystem and stated:

Such a strategy should recognize that all persistent toxic substances are dangerous to the environment, deleterious to the human condition, and can no longer be tolerated in the ecosystem, whether or not unassailable scientific proof of acute or chronic damage is universally accepted.

Gordon Durnil, who was appointed by President Bush to head the US delegation to the Commission, recalled at the January 1998 Wingspread conference how the commission reached this conclusion: "When we commissioners asked scientists what they knew about the effects of pollutants on people and wildlife, they would say they knew nothing for sure. Finally we began asking them what they believed was happening, based on their vast experience and observations. What those scientists of diverse backgrounds said then convinced me that we knew enough about the effects of those discharges to try to eliminate them altogether."


Trends and Future Importance

One of the most important expressions of the precautionary principle internationally is the Rio Declaration from the 1992 United Nations Conference on Environment and Development, also known as Agenda 21.
At the domestic and international levels, the debate is vigorous, as the stakes are high. Decisions are associated with significant risks to health and safety, the environment or natural resources and may result in crucial economic repercussions. Nations’ decisions that purport to protect human health and have disruptive economic repercussions on trading partners are most open to contention and often lead to allegations of trade protectionism.  

**Related Legislation and Regulations**

In Canada, the precautionary principle has been adopted in the Oceans Act (1996) and the new Canadian Environmental Protection Act (CEPA) (1999). CEPA has adopted the 1992 Rio definition of precautionary principle in the preamble, “Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (www.ec.gc.ca/CEPARegistry).

Canada has been flexible and responsive to the needs of particular circumstances when applying the precautionary approach. However, rules-based approaches are used where necessary to achieve the results required by specific legislation or international obligations.

**Linkages to Other Tools**

**Environmental Risk Assessment** — The process of quantitatively predicting the likelihood of an adverse response in humans or wildlife due to exposure to one or more chemicals. Sub elements include hazard identification, fate and transport, assessment of human or ecosystem exposure, estimation of absorbed dose, assessment of human health or environmental impact from exposure, risk calculations, cost-benefit analysis, risk communication and risk management.

**Key References**

The Canadian Environmental Protection Act (CEPA) — www.ec.gc.ca/CEPARegistry.

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59 Ibid.
Suggested Industry Best Practice Examples and Case Studies

3M Scotchguard
Green Building Design

Definition

Buildings have considerable impacts on the environment — during construction, throughout their operation, and during decommissioning at end-of-life. Green or “sustainable” building refers to design and construction practices that significantly reduce or eliminate the negative impact of buildings on the environment and its occupants through all life cycle phases of the building. It can be applied to the design of new buildings or renovations to existing buildings.

Key performance goals of green building design are:
• reducing energy demand and consumption;
• improving indoor air and environmental quality;
• optimizing operation and maintenance costs and prolonging the service life of the building;
• minimizing water consumption;
• efficiently using resources and materials;
• minimizing site impacts; and,
• managing and minimizing waste during construction.

How is it Used?

Green building design is applied throughout the design and construction of new or renovated facilities. Architects, engineers, planners and contractors apply green building design during the key phases of design and construction (see Box 1). Architects and engineers often utilize a range of tools to apply green building design (Box 2) throughout this process in order to improve the buildings performance in key areas (listed above). Design teams often work together in an integrated design process to optimize performance between these areas to reduce the environmental impact over the entire life cycle (see below).

Early green building designs tended to focus on one environmental issue at a time, such as energy efficiency or use of recycled materials. In the 1980s and 1990s, architects and engineers began to realize that integrating more than one key performance goal (e.g., reducing energy demand and consumption, reducing water consumption, etc.) produces a better performing building — environmentally and economically (e.g., green buildings not only reduce impact on the environment but can also substantially improve the overall economic efficiency of buildings by lowering building, operating, occupant absenteeism and health costs, etc.). Today, many

Box 1: Steps to Design and Construct (or Renovate) a Building
• Pre-design/Programming
• Conceptual design
• Design development
• Construction documents
• Pre-construction
• Construction phase
• Post-construction and Commissioning
guides, references, standards and databases are used to assist architects and engineers allowing green building design to rapidly become common practice within the industry.

**The Integrated Design Approach — Who’s Involved?**

Environmental factors are best integrated and considered at all stages of the design and construction (or renovation) of a building (Box 1) using an integrated design approach. The team-based approach involves the key members and disciplines involved in design and construction:
- architects;
- electrical, structural mechanical and civil engineers;
- heating ventilation and air conditioning engineers;
- landscape architects;
- contractors; and,
- users, occupants, tenants, etc.

This type of integrated design process (IDP) helps to ensure that all groups understand the interactions of different operating systems of a building (i.e., mechanical, electrical and lighting systems and the building envelope). IDP also ensures that a green building feature selected by one group is not nullified by decisions of another group (e.g., purchasing of light fixtures that do not meet efficiency specifications and generate excess heat, increases the cooling load on the HVAC system, thereby increasing operating costs and environmental impact).

**Tools for Green Building Design**

Design teams use a variety of tools to measure potential environmental impacts of buildings and to determine which impacts can be addressed (Box 2). The most significant decisions about incorporating green design into a new building are made at the beginning of the design

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process. However, tools can be used at many stages throughout the design process. Some tools are used to compare and select different building products (e.g., BRE Green Guide to Specification), simulate energy usage or lighting conditions or assess the performance of entire buildings (e.g., LEED, BREEAM). Other tools help design teams calculate trade-offs between materials or design specifications and the operational performance of the building (e.g., Greenscale).

Green Building Standards

While several voluntary guidelines or standards exist to help architects and engineers assess the performance and environmental impacts of building design, some also offer formal certification for buildings that meet these standards. Some of the recognized guidelines or standards include:

- **C-2000 Program for Advanced Commercial Buildings** developed by CANMET, Natural Resources Canada;
- **BREEAM and BREEAM/Greenleaf** — eco-rating procedures for buildings; and,
- **LEED™ (Leadership in Energy and Environmental Design) Green Building Rating System** developed by the US Green Building Council.

C-2000 involves technical and process requirements for design teams, while LEED and BREEAM both consist of rating systems weighted across several performance categories. Design teams accumulate points for each “green feature” in the building and, depending on the total points, the completed building is rated as Silver, Gold or Platinum (specific to LEED™) or Pass, Good, Very Good or Excellent (specific to BREEAM™). Design teams are free to pursue any points or credits within these systems to obtain a final certification that can be used for promotional purposes.

Who Uses It?

**Industry** — Internationally, many companies are starting to use green building design when constructing or renovating buildings (Box 3). Many architectural and engineering firms and their clients have developed or adopted green building checklist-type tools, while others demand the rigor of a building-rating program such as LEED™ or BREEAM™ to guide the design team toward improved environmental performance.

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USGBC has LEED™ certified 44 building projects and registered over 600 that are intending to certify, encompassing 18 different building types and more than 59 million gross square feet. Registered projects in countries outside of the US include Canada, China, India and Spain.

**Government** — In Canada, the Canada Green Building Council (CaGBC) is being formed to accelerate the design and construction of green buildings. The CaGBC will take over the administration of LEED™ in Canada from the US Green Building Council.  

The Canada Mortgage and Housing Corporation (CMHC), Enbridge Gas Distribution Inc., and Natural Resources Canada recently funded an independent study by the Athena Sustainable Materials Institute that, in part, resulted in a draft LEED™ Canada document indicating how LEED™ could be adapted to Canada. A copy of the study may be found at www.athenaSMI.ca.

A Canadian version of BREEAM for existing buildings was developed by Canadian Standards Association in cooperation with BRE and ECD Energy and Environment Canada. It was published by the Canadian Standards Association as CSA Plus #1132, which is a part of CSA’s Building Quality Management (BQM) Program.

Natural Resources Canada (NRCan) has a Buildings Group with a mission to develop and deploy building technologies and innovations that will help reduce energy consumption and lower greenhouse gas (GHG) emissions. Current initiatives administered by NRCan include the C-2000 program, the Commercial Building Incentive Program (CBIP), and others. NRCan and the Royal Architectural Institute of Canada also offer financial incentives for building designs incorporating renewable energy technologies. Visit www.raic.org or www.buildingsgroup.nrcan.gc.ca.

Governments across the globe are encouraging the use of green building design and construction. The European Climate Change Programme (ECCP) Sustainable Action Plan has set targets for government property procurement against BREEAM. Federal governments in the US and Canada are also encouraging adoption of green building standards.

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67 BREEAM Home page. http://products.bre.co.uk/breeam/health.html
Several US jurisdictions have green guidelines for building projects or are considering LEED™ adoption for State projects. These include:

<table>
<thead>
<tr>
<th>State</th>
<th>Use of LEED™</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>Considering LEED adoption for all State projects.</td>
</tr>
<tr>
<td>Maryland</td>
<td>Considering LEED adoption for all capital projects greater than 5,000 gsf.</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>Considering LEED adoption for all State projects.</td>
</tr>
<tr>
<td>Minnesota</td>
<td>Adopted “green” guidelines for facilities.</td>
</tr>
<tr>
<td>New Jersey</td>
<td>Encouraging use of LEED as voluntary guideline for school construction program.</td>
</tr>
<tr>
<td>New York</td>
<td>Encouraging all State projects to seek LEED certification. Also offers Green Building Tax Incentive Program.</td>
</tr>
<tr>
<td>Oregon</td>
<td>Offering Business Energy Tax Credit for commercial development – tied to LEED certification</td>
</tr>
<tr>
<td>Pennsylvania</td>
<td>Adopted “green” guidelines for facilities; LEED silver certification is required in new construction RFP’s issued by various State departments.</td>
</tr>
</tbody>
</table>

**Schools** — Many educational institutions are looking more seriously at green building design due to recently published research linking greener schools with improved learning and reduced energy use and costs. Green building addresses the environmental issues associated with conventional school buildings (such as poor ventilation, toxic materials, and inadequate natural lighting).

**Business Case**

Environmental, economic, and health and safety benefits of designing and constructing greener buildings have been documented through a number of private and public sector case studies. Figure 1 and Table 1 provide examples of business benefits of green building.

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Figure 1: Sustainable Facilities — Three Key Aspects

Environmental Concepts and Tools

Table 1: Benefits of Green Building Design

<table>
<thead>
<tr>
<th>Environmental Benefits</th>
<th>Economic Benefits</th>
<th>Occupational Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance and protect ecosystems and biodiversity. Improve air and water quality. Reduce solid waste. Conserve natural resources.</td>
<td>Reduce operating costs (See Box 4).(^71) Enhance asset value and profits. Improve employee productivity and satisfaction (See Box 5).(^72) Optimize life-cycle economic performance. Reduces future liability. Increase retail sales.</td>
<td>Improve air, thermal and acoustic environments. Enhance occupant comfort and health. Reduce healthcare costs. Improve employee satisfaction and morale — less absenteeism and turnover.</td>
</tr>
</tbody>
</table>


\(^{71}\) Ibid.

Box 4: Reduced Operating Costs

The headquarters of the Park Office Complex in Princeton, NJ, included four buildings comprising a total of 366,500 square feet. The complex used wastewater recycling for treatment and recycling of both “gray” and “black” water, reduced flows to 1,600 gpd (original design was 27,000 gpd). The innovative system costs $250,000 less than the originally contemplated treatment system, lowered operating costs, and accrued $15,000 per year in water bill savings.

Box 5: Increased Productivity

At West Bend Mutual Insurance Co.’s headquarters near Milwaukee, Wisconsin, environmentally responsive workstations give each office worker direct control of heating, cooling, task lighting and white noise levels within his or her desk area. A study comparing worker performance in the company’s old building and its new building revealed a productivity increase of 7.1 per cent, worth at least $364,000 annually to the company.
Environmental Concepts and Tools

Trends and Future Importance

The growing popularity of green building rating systems and guidelines are evidence that government, educational institutions and the private sector are placing increasing importance on greener building design. Many architects and engineers are now involved in green building design or sustainable design in response to expressed interest or requirements from their clients.

Green building design will continue to be primarily a market driven initiative because of the clear link to customer benefits (energy efficiency, cost reduction, productivity). It is

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**ING: What Green Building Really Means**

“The International Netherlands Group (ING) bank in Amsterdam is an unusual place. The 540,000-square-foot headquarters of the country’s second largest bank is one of the most remarkable buildings in the world. It is largely day-lit, highly energy efficient, and architecturally innovative. The building does not use conventional air conditioning — a feat virtually unheard of for a building of this size — relying primarily on passive cooling with back-up absorption chillers. The building uses less than one-tenth the energy of its predecessor and a fifth that of a conventional new office building in Amsterdam. The annual energy savings are approximately $2.9 million (1996 US dollars) from features that added roughly $700,000 to the construction cost of the building — a payback time of only three months. What is perhaps most unusual about this building is the way in which it was created. In 1978, ING’s Board of Directors laid out a strategy to deliver a functional yet cost-effective new headquarters that would be both appealing and environmentally responsive…[the building] would be "organic" and would integrate "art, natural materials, sunlight, green plants, energy conservation, low noise, and water." Next, the board assembled a multidisciplinary team [of] architects, building engineers, landscape architects, energy experts, and artists [that] worked for three years designing the building in a process requiring each step of the design to be understood by every member of the team. For example, if an artist didn't understand the natural ventilation system, its operation would be explained. Construction began in 1983 and was completed in 1987 — within budget. Not only has the bank building been a tremendous success financially, but employee absenteeism has dropped significantly. The bold new image of the bank — due in part to the new building — is credited with elevating International Netherlands Group from No. 4 to No. 2 among Dutch banks."

anticipated that green building design will gain increasing support from private and public organizations through the inclusion of green performance specifications in tenders and financial support for organizations, such as the Canadian Green Building Council.

Related Legislation and Regulations

Green building design and construction is predominantly voluntary; however, there has been some recent developments in this area in the public sector.

Under the New Buildings Program, the Government of British Columbia is currently developing a policy to green all new provincially-funded social capital facilities. For more on this, visit www.greenbuildingsbc.com/new_buildings/program_overview.html.

In the United States, the Federal Energy Management Program (FEMP) has adopted a federal mandate to develop more sustainable federal buildings. Executive Order 13123 (Efficient Energy Management) requires DoD, GSA (with DOE and EPA) to develop sustainable design principles, organized by the following categories: site, energy, materials, water, indoor environmental quality (IEQ), and operations and maintenance. The Order also requires the agencies to use life cycle cost analysis in making decisions about investments in construction, products, services, etc. The Federal agencies are currently working to incorporate sustainable design/construction goals, in compliance with the Executive Order.

Linkages to Other Tools

**Life Cycle Assessment (LCA)** — Taking a life cycle perspective is inherent in a green building approach, the ultimate goal being overall reduction of environmental impact throughout the life cycle of the building.

**Eco-Labelling** — LCA is used to identify the environmental impacts of a building and building products. The latter is most often communicated via eco-labels, such as environmental product declarations (EPD). See “Comparative study of national LCI/LCA based schemes in the building and construction sector” at www.environdec.com/agenda/eu_activities.asp.

**Environmental Management Systems (EMS)** — Both EMS and green building approaches are the result of increasing pressure to design, build and manage the buildings and operations of a business in an environmentally — and economically — sound manner. Increasing energy costs, water shortages, site impacts, emissions and the need to provide a healthy, productive workplace have become increasingly important for facility operators, building managers, architects and engineers.

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Environmental Impact Assessment — Assessing environmental issues and impacts associated with building design and construction is the starting point from which to make design and building improvements.

Stakeholder Engagement — Identifying the parties that should be engaged in building consultation and design is critical to ensuring overall success of a green building project. In addition to the design team itself, stakeholders that could be engaged in planning and design meetings include community officials, neighborhood representatives, building managers, landlords and other occupants (if a multi-tenant facility).

Key References

Natural Resources Canada Buildings Group. CANMet Energy Technology Centre. www.buildingsgroup.nrcan.gc.ca.


ASTM International Standards on Sustainability in Buildings:


Case Study Sources

Mountain Equipment Co-op Retail Stores — Montreal, Winnipeg, Ottawa
Liu Center at UBC — Vancouver
Mayo School, Mayo — Yukon
Jackson-Triggs Winery, Niagara-on-the-Lake — Ontario
Bentall Crestwood 8 office building — Vancouver, British Columbia
Headquarters for Yukon Power — Whitehorse, Yukon
Red River Community College — Winnipeg, Manitoba
Vancouver Island Technology Park – British Columbia
Stakeholder Engagement

Definition

“Stakeholders” can be defined as those groups who impact and/or are impacted by the company and its activities. Corporations are recognizing that their stakeholders comprise a much larger number of groups than previously understood. Over the last decade, the definition of “stakeholder” has expanded beyond the traditional groups to include social activists, communities, suppliers and other special interest groups (see Box 1 for a more inclusive list of stakeholder groups).

Stakeholders have become more global in their reach and have a better understanding of business than ever before. Generally, stakeholders are demanding more global transparency, and many want not only to be informed of a company’s activities and performance, but also to be involved in setting social and environmental performance objectives. Effective engagement of these various stakeholders is often cited as a key component of a company’s overall environmental or sustainability strategy.

Some believe that stakeholder engagement is the foundation of the corporate social responsibility (CSR) movement. The Conference Board of Canada defines CSR as “the overall relationship of the corporation with all of its stakeholders. These include customers, employees, communities, owners/investors, government, suppliers and competitors. Elements of social responsibility include investment in community outreach, employee relations, creation and maintenance of employment, environmental stewardship and financial performance.” Not only is stakeholder engagement a key part of CSR, but many companies agree that effectively engaging stakeholders is critical to keeping a pulse on society’s expectations of the business community.

How is it Used?

There is no “one size fits all approach” to stakeholder engagement. There are, however, some key elements of the approach companies can take to ensure they engage

stakeholders effectively and meaningfully.

**Key Elements**

1. **Designate responsibility** — Most companies emphasize the importance of having an internal champion(s) who is clearly responsible for ensuring that appropriate stakeholder engagement takes place.

2. **Develop principles to guide engagement** — Having formalized principles for stakeholder engagement can be very helpful to companies. Principles establish ‘rules of the game’ for fair and respectful dialogue and clarify expectations of all stakeholders. Formal principles also ensure a more consistent approach across all operations, and facilitate the integration of stakeholder engagement into managers’ performance requirements. See Box 2 for Suncor’s formal principles for stakeholder engagement.

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**Box 2: Suncor’s Principles for Guiding the Development of Stakeholder Relations**

- Those affected by Suncor’s business have a right to be informed about our activities, participate in a transparent stakeholder engagement process and be involved in issues and opportunities that affect them.
- Stakeholders will be provided with timely and accurate information about our business and Suncor will take into account the needs and concerns of stakeholders when making decisions on the company’s behalf.
- Suncor will actively seek stakeholder input on its business decisions and will respond to what we learn.
- Suncor will encourage stakeholders to define the manner they wish to be consulted with a view of being flexible and will strive to remain flexible and responsive to stakeholder preferences.
- Those acting on behalf of Suncor must be willing to be influenced by stakeholders and where appropriate, act on their input even if it means making changes to the company’s business plans.
- Suncor respects the values and culture of each stakeholder. When disagreement with stakeholders occurs and cannot be resolved, Suncor employees will always demonstrate respect for the diversity of views presented.

*Source: Stakeholder Relations at Suncor.*

www.suncor.ca/bins/content_page.asp?cid=3-266.
3. **Identifying key stakeholders** — Some companies have general criteria for selecting stakeholders (e.g., “We will work with organizations who…” “We will not work with organizations who…”) but new situations will always arise where companies need to be open to engaging those stakeholders who approach them for dialogue on certain issues. Companies need to determine who their priority stakeholders are (from list in Box 1) and include them in decision making that directly affects them. Alcan developed Figure 1 to illustrate whom it considers to be its key stakeholders, those impacted by its business operations. Companies can also be more strategic by seeking out stakeholders who are aligned with the company’s issues and can help the company to advance issues or solve complex problems. For example, Starbucks entered into a three-year partnership with an NGO, Conservation International (CI), to work together researching agricultural practices that reduce environmental impacts and improve the quality of coffee. It is a win-win situation for both parties. The partnership provides more visibility to CI’s efforts and Starbucks has benefited from CI’s knowledge and insight, and has been able to purchase shade-grown coffee from Chiapas, Mexico — an environmentally friendly alternative to traditional coffee beans.

4. **Identify the issues** — Companies have to communicate with, and listen to, its stakeholders to ensure they understand the real issues and then to delineate what can reasonably be addressed during the engagement. The company will need to understand the Who, What, Where, When and How of each situation to ensure a meaningful dialogue and outcomes with stakeholders.

5. **Determine appropriate method of engagement** — The actual method of engagement companies use with stakeholders differs in each situation, and maybe be dependent on the issues (type and duration), the stakeholders involved (local communities vs. employees vs. international NGOs), the business case for engagement (strong vs. weak), etc. Based on experience, companies effectively develop a “toolbox” of engagement methods from which they may draw. These range from informal (e.g., open house, focus groups — see Box 3) to formal (e.g., joint management committees, partnerships — see Box 4), and each method addresses certain goals or situations.

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77 Ibid.
6. **Implementation and exit** — Successful engagements depend on some type of action or follow through — stakeholders will not feel the engagement has been meaningful if there are no goals, or measurable results. It is also important for companies to find ways to measure the success of stakeholder engagement in order to justify the time and expense. Reporting and keeping stakeholders informed on any progress made is also crucial to successful relationships. Overall, transparency is very important. Companies exit engagements when issues are resolved or project goals are met. With some stakeholder groups, engagements are ongoing (e.g., employees, shareholders, etc.) or last for the lifetime of the operation or project and even long after closure or decommissioning (e.g., local communities).

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**Box 3: Petro-Canada Focus Groups**

To address public questions and concerns about the oil and gas industry and its practices, Petro-Canada came up with a unique initiative to share information and improve relationships with its neighbours. The company commissioned a series of focus groups in rural Alberta and British Columbia in 1998 with the purpose of gaining a better understanding of what local residents wanted to know about the company's upstream operations. These findings helped shaped Petro-Canada's *Operating in Your Neighbourhood* program, which is intended to provide local communities and neighbours with easy-to-understand information about the company's activities and environment, health and safety precautions.

Source: Community Involvement, Petro-Canada Corporate web site. www.petrocanada.ca/eng/about/environment/7088.htm.

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**Box 4: Teck Cominco and the Red Dog Mine**

In Alaska, Teck Cominco has partnered with the Northwest Alaska Native Association (NANA) Development Corporation to develop the Red Dog Mine on their lands. The formal partnership agreement creates a joint Management Advisory Committee, sets out provisions for addressing issues related to the operation of the mine (including environmental and wildlife management issues) and provides NANA shareholders with extensive employment and training opportunities. After over 12 years of operation, the workforce is now made up of about 60 per cent NANA shareholders.

Who Uses It?

**Industry** — A number of leading Canadian companies have focused on building strong stakeholder relationships as a key element of their business strategy. Each has different drivers for doing so and each has a different focus for who it considers to be its priority stakeholders. For example, Weyerhaeuser Canada focuses on its relationships with non-governmental organizations and local communities. Weyerhaeuser Canada has done a lot of work to improve its relationships with aboriginal communities, as they are the people often most directly impacted by the company’s business. VanCity focuses on effectively engaging its customers/shareholders (as it is a cooperative bank owned by its members) and local communities (because of its commitments to improving the local communities in which it operates). Other companies place more priority on customers and suppliers (e.g., Honda and Toyota). Each company has a different business case for why effective stakeholder engagement is critical to the success of its business.

**Government** — Not only are governments around the world utilizing stakeholder engagement to develop their own policies and programs, but governments are also encouraging companies to enter into dialogue with their stakeholders as a means of ensuring transparency and accountability. Many national governments have included stakeholder engagement as a key component of environmental assessment legislation. After the 2002 Summit on Sustainable Development in Johannesburg, South Africa, many governments and companies took up the challenge of increasing the number of multi-stakeholder partnerships that are part of key policy and program development. To help establish and maintain win-win stakeholder partnerships among business leaders and local authorities, the World Bank’s Development Communications Department has committed to “enhancing multi-stakeholder dialogue on CSR, especially on its environmental component, at the country level, and, to take on the role of facilitator of such a dialogue where it is needed”.

Overall, companies around the world are realizing the business value of engaging stakeholders and are putting more resources into managing this aspect of their business. The World Business Council for Sustainable Development (WBCSD) also promotes the concept of stakeholder engagement to its members. According to the WBCSD, stakeholder dialogue is: “about communicating with stakeholders in a way that takes serious account of their views. It does not mean involving stakeholders in every decision, or that ever stakeholder request will be met. It means that stakeholder input should be acknowledged and thoughtfully considered. It is about giving stakeholders a voice, listening to what they have to say, and being prepared to act or react accordingly.”

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79 Ibid.
81 Stakeholder Dialogue: The WBCD’s Approach to Engagement. Published by the WBCSD in November 2001.
The WBCSD has also developed a list of ten keys to successful engagement with stakeholders (presented in Box 5).  

**Investment Community** — The investment community is also starting to place pressure on the private sector to exercise greater corporate responsibility, including more fully engaging stakeholders in dialogues or partnerships aimed at better understanding and addressing stakeholder needs and expectations. These initiatives include but are not limited to:

- Dow Jones Sustainability Index — www.sustainability-indexes.com
- FTSE for Good Index — www.ftse4good.co.uk.
- shareholder resolution processes (e.g., see latest shareholder resolutions filed in the US by Interfaith Centre on Corporate Responsibility at www.iccr.org/index.htm).

**Non-governmental Organizations** — Non-governmental organizations of all denominations and backgrounds are participating in stakeholder engagement with companies, governments, and other national and international organizations.

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**Box 5: Ten Keys To Successful Stakeholder Dialogue**

- Allow enough time for planning, planning and more planning.
- Start thinking about the longer-term engagement process early and consult your stakeholders on how or if they want continued communication.
- Be aware of and manage expectations: yours and theirs.
- Be realistic: do not start what you cannot finish.
- Focus on quality not quantity; participants should be invited on the basis of credibility and ability to be thought provoking.
- Keep away from public positions and slogans; as soon as possible shift the focus of dialogue to specific interests and values.
- Acknowledge genuine differences, everyone should make an effort to share perspectives, listen and learn.
- Be prepared to be as open and transparent as possible.
- Aim to build joint ownership for actions towards change to be taken following the dialogue.
- Be flexible and open to improvisation in the program based on stakeholder desires.
Business Case

While there is little quantifiable research linking stakeholder dialogue with bottom-line benefits to companies, there is a growing body of anecdotal evidence showing why effectively engaging stakeholders is good for business. The following is a list of business benefits of stakeholder dialogue.\(^{83}\)

- **Strengthens license to operate** — Effective stakeholder engagement can help to develop a shared agenda, earn respect of local communities and strengthen the license to operate.
- **Reduces costs** — Engaging activists, suppliers and community groups may head off or significantly reduce legal and reputational costs of resolving conflict (see Box 6\(^{84}\)).
- **Strengthens shareholder value** — Many studies have shown that building positive stakeholder relationships is associated with other positive corporate characteristics (e.g., good treatment of employees and customers, strong management, etc.).
- **Builds markets and encourages innovation** — Direct engagement of customers and other interest groups can help companies develop new products and services, enter new markets, enhance existing market presence, etc.
- **Improves access to markets** — Stakeholder engagement practices often improve entry and success in emerging markets by establishing relationships with key customers and business partners (see Box 7\(^{85}\)).
- **Protects against negative customer actions** — By engaging stakeholders in dialogue about their interests and concerns, companies may be able to head off or minimize the impacts of boycotts organized by consumer groups to pressure companies to change business practice.
- **Increases organization effectiveness** — Dialogues with stakeholders can help companies to build skills and competencies, or to align company operations with its mission and values.

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**Box 6: Restoring Shell’s Reputation**

In 1995, Greenpeace galvanized community opposition to the deep sea disposal of the Brent Spar oil rig which compelled Shell to halt the project. Costs to change the disposal decision and to restore public image were estimated to be $200 million (US). Boycotts also led to lost sales at Shell service stations.

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\(^{84}\) Measuring the Business Value of Stakeholder Relationships Part 1. Produced by the Centre for Innovation in Management. Pages 11.

• **Bridges cultural gaps** — Stakeholder partnerships can help companies to build overseas operations or to overcome challenges of operating in markets with different cultures, laws and languages.

• **Reduces shareholder risk** — Companies like McDonald’s, Nestle, Nike, Shell and Texaco have all suffered damage to reputation and sales as a result of public awareness campaigns by advocacy stakeholder groups.

• **Enhances brand value** — Brand loyalty is a valuable intangible asset. For example, the 2000 rankings estimated brand values for Coca Cola and Microsoft at $72.5 and $70.2 billion (US) respectively.

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**Box 7: Expanded Market Opportunities**

Suncor has been actively developing the oilsands region in Alberta. Proactive and effective stakeholder engagement has expedited the company’s expansion in the area. Environmental permits were obtained 18 months ahead of schedule as a result of strong community support for Suncor’s operations.

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**Trends and Future Importance**

The nature of stakeholder engagement has changed dramatically over the last ten years (Box 8). These factors have lead to a key change in an organization’s view of engagement; in the past companies simply provided information, while today many stakeholders want to be directly involved in decision making processes. In many cases, companies are using stakeholder engagement to, among other things, enter challenging markets, resolve or head off confrontations with stakeholder activists, and improve or preserve their reputation in communities and the marketplace.86

Voluntary reporting and accountability initiatives, as well as international and regional standards and regulations (such as the European Union Directive for environmental management and ISO 14001), are encouraging some degree of public consultation.87 One of the three key principles of AccountAbility’s AA1000 Assurance Standard emphasizes stakeholder engagement: “Responsiveness: has the organisation responded coherently and consistently to stakeholders’ concerns and interests?”88

The Global Reporting Initiative’s (GRI) *Sustainability Reporting Guidelines* were developed through a multi-stakeholder engagement process, and also encourage stakeholder engagement as an important aspect of an effective sustainability reporting framework. As part of GRI’s “inclusiveness” principle, GRI recommends that “the reporting organization should systematically engage its stakeholders to help focus and continually enhance the

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86 Ibid.
Box 8: Changing Nature of Stakeholder Expectations

Over the last decade, the complexity and level of societal/stakeholder expectations of corporations has increased significantly:

- Issues have evolved from primarily economic and environmental concerns to social responsibility and governance.
- Performance expectations have evolved from regulatory compliance to stakeholders wanting companies to take on a stewardship role (expanding responsibility beyond the gate). More recently, there is a growing expectation that companies will take on corporate citizenship/responsibility (i.e., be active and ethical participants in the social, environmental and economic development of the communities they operate).
- While the initial focus of stakeholders was on facilities and operations, many stakeholders now are concerned with environmental, social and economic development issues associated with supply chains and product systems (i.e., cradle to grave).
- Stakeholders are demanding more transparency and accountability of corporations. Rather than accepting the company saying, “trust us,” stakeholders are moving beyond wanting to be informed to wanting to participate in decisions that affect them or the issues they are concerned about.

The inclusiveness principle is rooted in the premise that stakeholder ties are integral to meaningful reporting and must be incorporated during the process of designing a report. GRI also suggests that the following aspects of reporting can be enriched by stakeholder consultation: the choice of indicators; definition of the organization’s reporting boundaries; the format of the report; and the approaches taken to reinforce the credibility of the reported information.

Related Legislation and Regulations

Hard legislation supporting adoption of stakeholder engagement can be found in environmental assessment legislation (e.g., CEAA). However, the majority of government policies promote the voluntary adoption of stakeholder consultation and dialogue among industry.

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90 Ibid.
Linkages to Other Tools

**Environmental Management Systems (EMS)** — A key component of successful EMS implementation is the ongoing, transparent discussions between the organization and its regulators and other stakeholders.

**Corporate Environmental Reporting** — Reporting can be seen as a key communication technique between an organization and its stakeholders.

**Environmental Supply Chain Management (ESCM)** — ESCM can be seen as a key tool to the ongoing management of suppliers — a key stakeholder.

**Green Building Design** — A key component of building design and construction is the early engagement of community and regulatory stakeholders to ensure an acceptable and optimum design for the community.

**Key References**

Business for Social Responsibility — www.bsr.org
Centre for Innovation Management: SFU Business, Simon Fraser University — www.cim.sfu.ca/index.htm
AccountAbility/Institute of Social and Ethical Accountability — www.accountability.org.uk/default.asp.

**Possible Case Study Sources**

Suncor
Falconbridge/Noranda
VanCity
Shell Canada
Weyerhaeuser Canada