



Why Take A Life Cycle Approach?



Life Cycle

Initiative





Copyright 2004 UNEP
Printed by St. Joseph Print Group on
50% recycled paper, 15% post consumer
recycled content.

This publication may be reproduced in whole
or in part and in any form for educational or non-
profit purposes without special permission from
the copyright holder, provided acknowledgement
of the source is made.

UNEP would appreciate receiving a copy of
any publication that uses this publication as
a source.

No use of this publication may be made for resale
or for any other commercial purpose whatsoever
without prior permission in writing from UNEP.

First edition 2004

The designations employed and the presentation
of the material in this publication do not imply
the expression of any opinion whatsoever on
the part of the United Nations Environment
Programme concerning the legal status of any
country, territory, city or area or of its authorities,
or concerning delimitation of its frontiers or
boundaries. Moreover, the views expressed do not
necessarily represent the decision or the stated
policy of the United Nations Environment
Programme, nor does citing of trade names or
commercial processes constitute endorsement.

Information contained herein does not necessarily
reflect the policy or views of the Society of
Environmental Toxicology and Chemistry (SETAC).
Mention of commercial or noncommercial
products and services does not imply
endorsement or affiliation by SETAC.

UNITED NATIONS PUBLICATION

ISBN: 92-807-24500-9

Contents

Forewords	2, 3
Opportunities in our Community, our Economy, & our Environment	4
What is a Life Cycle Approach?	6
A Life Cycle Approach Promotes...	8
From Concept into Practice	10
<i>Life Cycle Thinking In Daily Decisions</i>	
<i>Life Cycle Thinking In Government Policy</i>	
<i>Life Cycle Thinking In Business</i>	
<i>Life Cycle Tools</i>	
Life Cycle Thinking Generates Value & Benefits	19
Who is Using a Life Cycle Approach?	20
What Can I Do?	20
UNEP DTIE, SETAC & The Life Cycle Initiative	21, 22
Partners	23
Acknowledgements	24

Highlights

The following highlights illustrate a life cycle approach in practice.

- a) Partnering To Develop In A Sustainable Way – Danish Environmental Protection Agency
- b) Avoid Shifting Problems From One Part Of The Environment to Another – Methyl Tertiary Butyl Ether (MTBE)
- c) Life Cycle Considerations In Thai Green Labels
- d) Environmental Improvement & Growing Consumption – UNEP
- e) Educating People On Environmental Impacts Of Consumption & Use– Washing Powder Manufacturers
- f) Life Cycle Thinking In French Recycling Policy
- g) Life Cycle Approach To Developing Policy For Pesticides In Costa Rica
- h) Environmental Design For Business Reasons – Donau Tufting GmbH
- i) Providing Life Cycle Information To Business Customers – ABB
- j) Modeling The Waste Stream Life Cycle In México To Promote Integrated Waste Management
- k) Calculating The Total Cost Of Ownership – The Life Cycle Costs
- l) Promoting a Life Cycle Approach In Sustainable Production & Consumption In Eastern & Southern Africa

Foreword



Fritz Balkau

Head, Production
& Consumption
Branch
UNEP Division of
Technology,
Industry and
Economics

In 2002, the United Nations Environment Programme, (UNEP), joined forces with the Society of Environmental Toxicology and Chemistry (SETAC) to launch the Life Cycle Initiative, an international partnership to put life cycle thinking into practice. The initiative is a response to the call from governments for a life cycle economy in the Malmö Declaration (2000), and it contributes to the 10-year framework of programmes to promote sustainable consumption and production patterns, as requested at the World Summit on Sustainable Development in Johannesburg (2002). The first action of the Life Cycle Initiative was to draft definition studies to determine a road map for the next years on how to develop and disseminate practical tools for evaluating the opportunities, risks, and trade-offs associated with products and services over their entire life cycle to achieve sustainable development. A second task was to prepare the present brochure to raise awareness among executives and managers in industry, governments, and civil society on the

advantages of taking a life cycle approach for making sustainable decisions. Spreading the idea of life cycle thinking is an important part of UNEP's promotion of an integrated approach to sustainable consumption and production. The current form of life cycle analysis can tell us what the materials and energy flow is and where the impacts occur. To make decisions in a life cycle perspective, however, we need to move to life cycle management. Therefore, we need to include a key player analysis at important stages in the chain, a systematic study of policy options, and a management model for addressing impacts in a holistic way. That means we still have much to do, and the Life Cycle Initiative has an important future ahead of it. We in the production and consumption branch of UNEP hope that this brochure, as well as other activities of the initiative, will help to raise awareness of life cycle approaches around the world and assist in their effective implementation.



James Fava

Managing Director,
Five Winds
International
www.fivewinds.com

Much has occurred in the area of life cycle since 1989 when a small group representing the United States Environmental Protection Agency (US EPA), Battelle, Procter & Gamble and myself met in Cincinnati, Ohio, USA to discuss the possibility of a workshop on what was to become “life cycle assessment.” Since that workshop hundreds of organizations have completed LCAs of product systems. LCA has become a leading tool within businesses and government to understand and manage risks or opportunities associated with products over their entire life cycle (that is, from material acquisition, production, use and eventual disposal). With the leadership of SETAC, UNEP, and International Organization for Standardization (ISO), civil society has come a long way in understanding and using life cycle approaches. Yet there is still much to do.

Under the current partnership among SETAC, UNEP, and all of the sponsors of the UNEP/SETAC Life Cycle Initiative, we have had several successful years laying the foundation to move life cycle thinking and approaches to another level. The International Life Cycle Panel – highest body of the Life Cycle Initiative – approved in January 2003 the desire to prepare additional information materials on the value of life cycle approaches for a broader audience. This Why Take a Life Cycle Approach brochure is a small step to build greater understanding of life cycle approaches and their value towards creating more sustainable forms of design, production, and consumption. We illustrate through clear examples how life cycle thinking and other approaches have been or can be used to improve the way we think about problem solving and use the information available to us.

I would like to thank all of the International Life Cycle Panel members and the Initiative’s Executive Committee for their extremely valuable comments and suggestions. Special thanks goes to Jennifer Hall (Five Winds International) and Guido Sonnemann (UNEP/SETAC Life Cycle Initiative Secretariat) for their tireless energies and efforts to make this brochure a reality.

“Consumers are increasingly interested in the world behind the product they buy. Life cycle thinking implies that everyone in the whole chain of a product's life cycle, from cradle to grave, has a responsibility and a role to play, taking into account all the relevant external effects. The impacts of all life cycle stages [materials and manufacturing, use by the customer, disposal and handling at end of use] need to be considered comprehensively when taking informed decisions on production and consumption patterns, policies and management strategies”

Klaus Toepfer
Executive Director, UNEP

Opportunities in our Community our Economy, & our Environment

Today, there is opportunity for each of us to make well-informed choices – both as individuals and for the companies and governments where we work. A life cycle approach is one part of finding and attaining these opportunities.

There are opportunities for different nationalities, cultures, professional disciplines, governments, businesses and Non Governmental Organisations, (NGOs) to become partners, working together to develop in a sustainable way. We have greater ability to cooperate, to be informed about the source of our environmental, social, and economical challenges, and to engage people on a global and local scale to address these challenges (highlight a).

These opportunities are enhanced as:

- people from across the globe use new communication technologies to connect and interact with each other
- we share knowledge amongst countries and trade services, materials, and products such as foods and medicines

- we read detailed information about the services and products we select from our own community or from around the world
- and as businesses, governments and other organizations use information to understand how to act as responsible global citizens – then use their influence to bring more value to their communities.

The purpose of this brochure is to introduce a life cycle approach as one means to help us recognize opportunities, balance opportunities with risks and make choices that contribute value to our economies, our natural environments, and our communities.

Reading this brochure will help you understand what a life cycle approach means and how individuals, businesses, and governments take that approach. It also illustrates the benefits and suggests where you can find out more!

“... the root causes of global environmental degradation are embedded in social and economic problems such as pervasive poverty, unsustainable production and consumption patterns, inequity in distribution of wealth, and the debt burden... success in combating environmental degradation is dependent on the full participation of all actors in society, an aware and educated population, respect for ethical and spiritual values and cultural diversity, and protection of indigenous knowledge”

Ministers of the Environment, The First Global Ministerial Environment Forum, Malmö, Sweden, May 2000

Life cycle approaches help us to find ways to generate the energy we need without depleting the source of that energy and without releasing greenhouse gases that contribute to climate change.



a) Partnering to Develop in a Sustainable Way

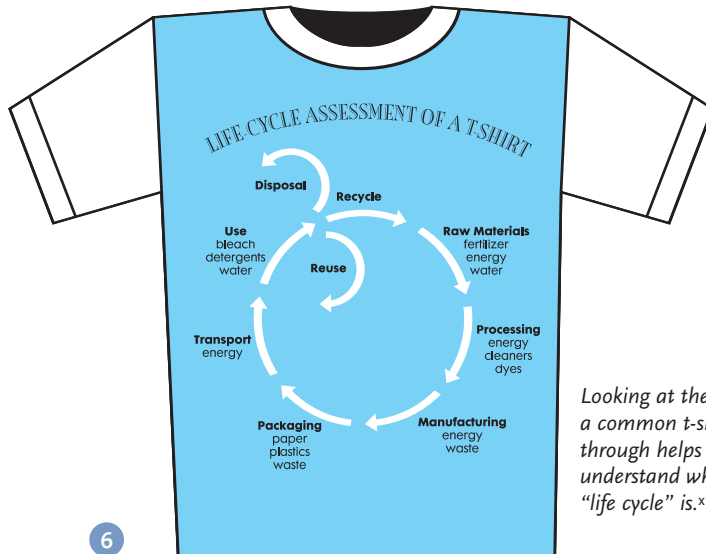
“Somewhere in northern Europe a group of environmental experts are meeting to discuss how to solve the problems related to [the chemicals used] in televisions [to prevent accidental burning]. At the same time access to clean drinking water is being discussed at a meeting of the European Commission in Brussels, and a little later in the day a group of diplomats will gather in New York to prepare for the next global conference on the environment. In Poland a new water treatment plant will be opened on the same day so that the Baltic Sea will become a little less polluted, and at the Danish Environmental Protection Agency (Danish EPA) we are receiving a visit from our colleagues from Egypt.”

“These are all examples of activities that are made possible because of a global network of partners involved in caring for our common heritage – the Environment of the Earth. In some way or other the Danish EPA will be involved, simply because we can only solve environmental problems through international cooperation in which we commit each other to initiatives, and where different countries can share experience, knowledge, and technology”.

Danish Environmental Protection Agency, excerpt from Working for a Cleaner World.

What is a Life Cycle Approach?

A system, or life cycle can begin with extracting raw materials from the ground and generating energy. Materials and energy are then part of manufacturing, transportation, use (wearing and washing the t-shirt, for instance), and eventually recycling, reuse, or disposal. A life cycle approach means we recognize how our choices influence what happens at each of these points so we can balance trade-offs and positively impact the economy, the environment, and society. A life cycle approach is a way of thinking which helps us recognize how our selections – such as buying electricity or a new t-shirt – are one part of a whole system of events.



Looking at the stages a common t-shirt goes through helps us understand what a "life cycle" is.^{xii}

"The global plastics industry has been a long-time advocate of life cycle thinking and eco-efficiency as methods to demonstrate and optimize the resource, efficiency, functionality, and performance characteristics of plastics throughout the full value chain of its products, while minimizing emissions and environmental impacts of plastics on society. PlasticsEurope (formerly APME) and the American Plastics Council provide polymer life cycle inventory databases to help users of plastics – manufacturers, academia, governments, NGOs, and the public – better understand the contributions plastic products make towards sustainable development, while creating a lighter footprint on the environment"

**Mike Levy, American Plastics Council,
life cycle coordinator
and Executive Director,
Polystyrene Packaging Council &
EPS Resin Suppliers Council**

A life cycle approach identifies both opportunities and risks of a product or technology, all the way from raw materials to disposal. To do this there is a continuum of life cycle approaches from qualitative (life cycle thinking) to comprehensive quantitative approaches (life cycle assessment studies). People,

companies and governments use these various life cycle approaches in anything from day to day shopping, selecting office supplies for the workplace, engineering a new product design, or developing a new government policy.



Food grown in one region is often transported and sold all over the world. Agricultural practices are an important part of the life cycle of foods we eat, but so is transportation. Foods transported long distances by airplane, ship or rail to markets can have a larger impact on the environment than foods which are eaten locally, because of the energy and emissions from each different type of transportation.

“Human needs should be met by products and services that are aimed at specific ‘functions’ such as food, shelter and mobility, and that are provided through optimized consumption and production systems that do not exceed the capacity of the ecosystem.”

**Life Cycle Initiative Brochure, UNEP SETAC
‘International Partnership’, 2003**

A Life Cycle Approach Promotes ...

... Awareness that our selections are not isolated, but influence a larger system. Buying office paper is a good example. If you knew that it takes 24 trees to create 50,000 sheets of office paper and 2.3 cubic meters of landfill space to dispose of it, you might choose paper made from recycled material and elect to support paper producers that source from sustainably managed forests.

... Making choices for the longer term and considering all environmental and social issues associated with those. Life cycle thinking helps us avoid short term decisions that lead to environmental degradation – such as over-fishing or polluting our air with mercury.

... Improving entire systems, not single parts of systems, by avoiding decisions that fix one environmental problem but cause another unexpected or costly environmental problem (like mitigating air pollution yet increasing water pollution, highlight b). Life cycle thinking helps avoid shifting problems from one life cycle stage to another, from one geographic region to another and from one environmental medium (air, water or soil) to another.

... Informed selections, but not necessarily ‘right’ or ‘wrong’ ones. Life cycle thinking simply helps us put our decisions in context with facts from all parts of the system or life cycle. It means we look for unintentional impacts of our actions (such as damaging a natural eco-system or inadvertently supporting unfair labour conditions and wages) and take some action to prevent those impacts (such as purchasing office paper from sustainably managed forests or coffee certified “fair trade”). For instance, if the shop around the block from your office sells coffee grown by workers who receive a fair wage on the world market, cultivated without pesticides that harm people planting or harvesting the beans and from a plantation that did not cause an endangered forests to be chopped down, you might choose to purchase your daily cup from that shop.

“Corporate membership of the International Council on Mining and Metals (ICMM) - comprised of 15 of the world’s largest mining and metal producing companies - has signed an undertaking to recognise existing World Heritage properties as ‘no-go’ areas”

International Council on Mining & Metals, August 2003 news release



Office paper and cardboard packaging can be made of wood from sustainably managed forests or from recycled paper. Beans for your office’s coffee machine can be grown organically and certified “fair trade”. This means farmers were paid a minimum, internationally established price per kilogram, among other things.



The fishing industry is one to recognize the importance of long term planning and decisions, a key part of life cycle thinking. Planning for the long term ensures today’s decisions support future activities, (photo by Telfer Wegg).

When life cycle thinking informs our activities, such as electricity generation, we may avoid fixing one environmental problem while unknowingly causing another (switching from nuclear power generation to coal fired generation prevents nuclear waste but releases mercury which damages ecosystems and human populations).

From Concept Into Practice

More and more people are basing their decisions on life cycle information, in effort to gain the most from their actions without unintentionally jeopardizing their ability to thrive in the future.

Life cycle thinking applies to the daily decisions we make at our homes and workplaces, decisions about creating services and how we develop our communities. Citizens, businesses, and governments are finding ways to promote life cycle thinking and balance the impacts of their choices.



Thinking about how our industries and homes use water and what we release into our water systems are key life cycle considerations. With life cycle information, we can design industrial processes and use raw materials in ways that preserve water quality and access to clean water around the world. Amapa, Brazil.

Photo by Pratginestos, ©WWF-Canon.



A life cycle approach to community planning and development can lead to fewer environmental impacts from materials used, construction practices, and waste management, as well as the energy and water used by people living and working in the community. Photo: Sydney Olympic Village

b) Avoid Shifting Problems from One Part of the Environment to Anotherⁱ

MTBE (Methyl Tertiary Butyl Ether) is added to gasoline to increase octane levels and enhance combustion, which in turn reduces polluting emissions. MTBE in gasoline can reduce ozone precursors by 15%, benzene emissions by 50%, and CO emissions by 11%. While MTBE helps mitigate air pollution, the MTBE itself may be toxic if not combusted fully. Levels of MTBE in the environment are now measured when MTBE is suspected to have evaporated from gasoline or leaked from storage tanks, lines and fueling stations. Of most concern is the MTBE found in lakes, reservoirs, and groundwater for potable water supplies. In some cases, MTBE concentrations already exceed standard indicators for potable water, including "taste and odor" and "human health". While MTBE is not considered highly toxic, there is insufficient information available on its long-term toxicity, including carcinogenicity and reproductive toxicity, to humans, animals and ecosystems. This situation illustrates the drawbacks of not taking a life cycle approach. Focusing on air quality, without thinking of water or land, and on only one stage of the car's life cycle (namely emissions during use) generated unforeseen, adverse effects in other environmental media and life cycle stages. While there is not always an easy choice, it is important to understand potential impacts associated with each choice. In this case, taking a life cycle approach to evaluate MTBE may have alerted decision-makers to potential water contamination problems and allowed us to prevent contamination by producing, transporting and storing MTBE more effectively.

Life Cycle Thinking in Your Daily Decisions

As consumers, we can look for life cycle information about the products and services we buy – do they entail the use of energy, illegal labour conditions, the production of hazardous waste, the destruction of an endangered ecosystem, or the pollution of air and water? We can try to find out if the businesses we regularly buy from have initiatives to address these issues and look for ways to support that work. For some products and services, eco-labels and other types of environmental and social information demonstrate the awareness of the businesses we buy from (highlights c & d). We can also look for information that tells us how we should use, care for, recycle or discard products effectively (highlight e). All of this information is becoming increasingly available for products, and services ranging from foods such as fish and other meats to washing powder, hotels, cars, paper products and computers, among many others. Sometimes a simple label can tell us whether the mobile telephone we are buying or the golf course we're using has fewer environmental impacts than certain alternatives.

"The Minister of Norway emphasized the relevance of promoting "eco-efficient" consumption by discussing the "importance of enabling consumers to make informed product choices through life cycle analysis, eco-labeling initiatives and other information tools,"

Mr. Borge Brende, Minister of Norway, Ministerial Meeting of UNEP's Governing Council, February 2003.

c) Life Cycle Considerations in Thai Green Labels

Thailand's Ministry of Industry, the Thailand Business Council for Sustainable Development, the Thai Industrial Standards Institute, and the Thailand Environmental Institute wanted to encourage businesses to improve the environmental quality of their products and services by stimulating consumer demand for such products. In October 1993, the group initiated the Green Label Scheme – a scheme to establish product criteria and certify products with less impact on the environment, compared to other products serving the same function. The product criteria are based on the significant impacts a product may have on the environment during its life cycle (referred to as life cycle consideration), as well as how easily businesses could meet criteria with reasonable process changes or improvements.ⁱⁱ



d) Environmental Improvement & Growing Consumption

UNEP's global status report on sustainable consumption describes how improvements in efficiency – such as reducing the amount of waste or energy per product or service generated – are being offset by increased consumption of these products and services. For instance, the benefits of low-energy light bulbs are lost if we leave the lights on for longer periods and energy efficient appliances bring less benefit if we buy larger appliances than we need. Improving efficiency and reducing consumption should go hand-in-hand to ensure we achieve real improvements for our environment and our communities.



“Consumers will give preference to products and services that they understand will make a smaller footprint. Consumer information needs to be as simple as possible consistent with maintaining its integrity; be reliable over reasonable time frames; and seem sensible to consumers when interrogated more deeply”

Louise Sylvan, President, Consumers International.



Hanging clean laundry out to dry can save energy. Moreover, clothes can be washed effectively in a manner that does not waste electricity, water, or soap.

Products with certain environmental performance may apply for Eco-labels – shown here are Thailand's Green Label, Australia's Environmental Choice Logo, and the Marine Stewardship Council's label for fish products.

e) Educating People on Environmental Impacts of Consumption and Use ⁱⁱⁱ

Several major manufacturers of laundry soap studied the life cycle of a typical laundry washing powder. They examined how different ways of producing the powder, packaging it, transporting it, and using it impact our environment. They found that while washing powder does contribute to water pollution, people could use the washing powder in ways that prevent the amount of pollution generated and reduce the need for high water temperatures (thus, energy). Knowing this, these companies created television advertisements and information brochures informing people about properly using washing powders – promoting more sustainable consumption. If the education campaign is effective, water pollution is reduced, energy use falls, and customers are happier because using the proper amount also means clothing is cleaned more effectively. In this way, the companies provide their customers with good service and an effective product.

Life Cycle Thinking in Government Policy

When governments design policy, negotiate voluntary agreements with industry, decide where to invest resources, commission new office buildings, or even purchase paper for offices, life cycle thinking can apply. Measuring potential life cycle impacts of decisions can help governments to:

- Inform government programs (highlights f & l) and **help prioritise** these programs (highlight g), based on life cycle information.
- **Make policies more consistent** among consumers, producers, material suppliers, retailers, and waste managers and also among different policy instruments (such as harmonising regulations, voluntary agreements, taxes, and subsidies).
- Purchase products and services which are “environmentally preferable”, **reduce the impact** government operations have on the environment (highlight j & l) and **support regional and global markets** for “preferable” products and services.
- Promote pricing products and services to **accurately reflect the costs** of environmental degradation, health problems, erosion of social welfare, and impacts at other life cycle stages. Such “price signals” can send messages to consumers and provide incentives for businesses to continuously improve the environmental and social performance of products or services, across each stage of the life cycle.^{iv}
- Introduce take-back systems to establish a recycling-based economy according to the hierarchy **reduce, reuse and recycle**.

f) Life Cycle Approach in French Recycling Policy

ADEME, France’s Environment and Energy Management Agency, gathered results from life cycle studies that had been conducted on 11 different products and types of packaging, such as paper, aluminum, and plastic packaging. ADEME compared the environmental impacts from recycling the product or packaging with impacts from incinerating it, landfilling it, or otherwise disposing of it. For example, ADEME’s comparison showed that recycling plastic is environmentally beneficial if the recycled plastic is used in a product in place of virgin plastic. However, if the recycled plastic is used in place of wood, it would have been more environmentally beneficial to incinerate that plastic and recover the energy from the incinerator (i.e., recycling is not favourable). The French government has used this life cycle information to inform their laws on recycling, waste prevention, and responsible “end-of-life” management for products and packaging. In France, it may soon “... become the responsibility of producers, importers and distributors of products (and materials in those products) to manage or contribute to eliminating waste from those products...” (translated from ART L541-10 du Code de l’Environnement).



The use of pesticides can help crops grow, but it also poisons 3.5 to 5 million people around the world each year when pesticides infiltrate our air and water, causing long-term damage that is costly to reverse.

g) Life Cycle Approach to Developing Policy for Pesticides in Costa Rica

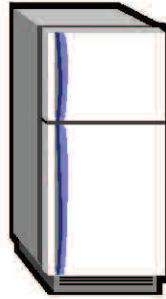
For several years, Costa Ricans have expressed concerns about the damage pesticides may be causing to their health and the environment. National and international NGOs voiced many concerns about pesticides used to grow bananas, strawberries, ferns, and flowers, which were echoed by some regulatory agencies. These concerns were based on perceptions and lacked scientific background, so the Costa Rican Controller's office carried out a project in 2002 using a life cycle approach to understand pesticide use and its consequences on health and the environment in Costa Rica. Twenty-five of the active ingredients most used in pesticides in Costa Rica in 1998 were analyzed, and several types of exposure to these ingredients (to health and environment) were considered. In the end the project found that five of the active ingredients were responsible for roughly 95% of the impact on human health, while three of the active ingredients were accountable for 90% of the impacts on the environment. The Controller's Office understood that these results were only a first "screen" of how these active ingredients affect human health and the environment in Costa Rica; however, the Office was still able to use this information to advise other regulatory agencies on these active ingredients (Ministry of Agriculture, Ministry of Environment, among others). This life cycle approach in policy making was welcomed and was incorporated in a collaborative and relatively inexpensive manner. It is hoped that centers of higher education, regulatory offices, and producer's associations in Costa Rica will incorporate life cycle thinking to inform future decisions.

"... It is time to leave behind this piecemeal approach to environment and to pursue a broader more holistic view of sustainable development through a life cycle approach in our policy making..."

Federico Malavassi, Vice-President of Costa Rica's Congress, opposing a proposed Constitutional Amendment on Environmental Matters, May 2002

Life Cycle Thinking in Business

Businesses design and manufacture the refrigerators, carpeting, soap, and other products we purchase. To do this, a business and its employees in design, sales, and finance make many choices to balance customer satisfaction, quality, innovation, safety, costs, and more. Thinking in terms of the life cycle, businesses recognise that each choice sets the stage for not only how the product will look and function, but also for how it will impact the environment and the community as it is manufactured, used, disposed, or re-used and recycled. For example, washing machines, refrigerators, and other appliances can be made from recycled materials, be free of harmful substances, use minimal water and energy, and be designed to have a long life. Each product characteristic is determined when the product is designed and will impact the environment differently.



Products can be designed so they will have less environmental impact when they are manufactured, used, and discarded (Danish EPA). Today, refrigerators are made without CFC refrigerants that harm the ozone layer, and some models are also designed to use half as much energy as they did 10 years ago."

To make decisions during product design, businesses research where the raw materials might come from, which manufacturing processes may be needed, who will use the product, what type of maintenance and cleaning might be required, what types of waste will be created, and where the product will go when it is discarded. To find this out, designers conduct life cycle studies and measure the potential impacts of various options (highlight h).

Businesses also request such information from suppliers (highlight i). With life cycle information, companies are able to calculate the full life cycle cost of the goods they purchase. This includes the point-of-purchase price as well as the costs of transporting, storing, installing, cleaning, operating, repairing, and eventually discarding those goods – also known as the 'total cost' of owning that product (highlight k).

h) Environmental Design for Business Reasons

The German carpet producer Donau-Tufting GmbH conducted a life cycle study of their carpet production. Based on what the study found, Donau-Tufting decided to remove heavy-metal colourings and vulcanization chemicals from the carpets they make. The company gained an advantage in the market over its competitors, as the new carpet achieved an additional 25% turnover.



Many life cycle issues can be decided or influenced depending on how a product is designed.

"... The life cycle approach for Rio Tinto makes good business sense; it is seen as a means to assess process improvements in terms of their contribution to sustainable development and it adds value by strengthening the supplier-customer relationship resulting in product differentiation and premiums,"

Bill Adams, Rio Tinto

A product designed with better environmental, social and economic performance across its life cycle may have benefits the company can communicate to its customers (highlight h & i). Some businesses elect to use product declarations or other labels to market environmental and social attributes to their customers.

There are international standards for these business-to-business communications or “environmental product declarations”. Each declaration must be based on a life cycle study and tell the business customer about the life cycle environmental impacts of the component or product being purchased. Declarations exist for building and construction products, refrigerators and other appliances, chemicals, train cars, dairy products, and circuit breakers, to name a few (highlight i).

Life cycle thinking that influences product design, strategic planning, procurement, and sales helps businesses:

- **Enhance their image** and the value of their brands – businesses can avoid criticism and participate in issues abroad or beyond their direct sphere of influence. Financial indices such as the Dow Jones Sustainability Indexes (DJSI) track and report the financial performance of leading sustainability-driven businesses, worldwide.
- Find **new ways for marketing** and sales departments to communicate and interact with customers – some fifty percent of businesses say they are interested in learning about sustainability.^{vi} This means a company can promote its products and services by talking about its social and environmental attributes (highlight i).
- Share life cycle information with suppliers, customers, and waste handlers to identify risks and **opportunities for improvement** – the risks might relate to the environment, human health, safety, and finance, while opportunities could include

growing market share, brand image, effective use of materials, and innovation. Together, businesses can find new ways to improve output while optimising their use of time, money, labour, and material input (highlight e).

i) Providing Life Cycle Information to Business Customers

Market interest in environmental information on products that is credible, unbiased, verifiable, and covers the entire life cycle is growing. To be complete, the information should cover the product life cycle from acquiring raw materials to recycling those materials when the product is no longer in use. Environmental product declarations (EPDs) are meant to provide this type of information in business-to-business communication, promoting “green procurement” in the business and public sectors. Companies use EPDs to communicate their product’s environmental performance. ABB, a global manufacturer of power and automation technologies for utility and industry customers, has more than 40 EPDs for a range of its products. EPDs include information about any hazardous substances, disassembly, recovery, and recycling of used products and waste. Quantified life cycle information from an EPD is also a necessary input for many ABB customers working to modify and improve the environmental performance of their products and services through eco-design and innovation. Find out more about EPDs at <http://www.environdec.com>.



ABB studies the life cycle of certain products – including this motor – from production of raw materials to the time they are taken out of service. ABB publishes results in Environmental Product Declarations for its customers, investors, and other interested parties.

“To help ourselves succeed and to show that aluminum has high sustainability value, we need to make sure that what we do is transparent and measurable. One tool to do this is Life Cycle Analysis. LCA allows us to demonstrate the long-term value of our products and the renewable nature of aluminum, and to communicate those characteristics to our stakeholders”

John Pizzey, Alcoa, Executive Vice President of Primary Products.

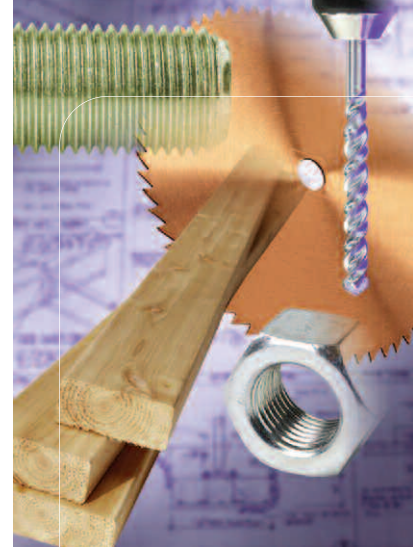
Life Cycle Tools

Life cycle thinking can be put into practice in many ways... involving a number of different “tools”. Referring to eco-labels, sustainability indices, and company reports on environmental and social issues helps individual citizens bring life cycle thinking into purchasing decisions. Governments take a life cycle approach to policy making by involving a wide range of stakeholders (such as via Product Panels), life cycle modeling (highlight j), or new policy approaches (such as Integrated Product Policy). In private sector companies, engineers and designers apply life cycle thinking when designing products and services, via studies based on Life Cycle Assessment (highlight h), Total Cost of Ownership calculations (highlight k), Design-for-Environment programs and management systems oriented toward products or facilities. Quantitative and qualitative tools for mapping life cycles and measuring impacts continue to evolve as more professionals apply life cycle thinking and ask for life cycle information. For more information about these tools, please visit <http://www.uneptie.org/pc/sustain/lcinitiative>.

j) Modeling the waste stream life cycle in Mexico to promote integrated waste management ^{vii}

Waste management systems that are environmentally effective and economically affordable are known as Integrated Waste Management systems. Integrated Waste Management uses several different treatment options for waste at a local level and selects these options in context of the entire solid waste stream (including sources and types of waste, recovery options, reuse, and various disposal options). In 2003, Mexico adopted a law promoting an integrated approach to waste management that is supported by life cycle assessment studies. The intent is to ensure that decisions are based on credible data to optimise the waste management system. Computer models of the waste stream life cycle provide this type of information for decision makers. To date, studies on waste characterisation and life cycle modelling are underway in Cuernavaca and Valle de Bravo, Mexico.

A number of different tools are often needed to accomplish one task or meet one objective.



k) Calculating the Total Cost of Ownership – the Life Cycle Costs

A business which makes industrial cleaners worked with its chemical supplier to identify the life cycle costs of manufacturing, purchasing, using, and disposing of the chemicals supplied. Together, they used the results to identify changes in the formulation of the cleaner to reduce these costs. Next, the business approached its customer who purchases the cleaner to wash buses, subway cars, and train cars.

The business calculated that this customer was paying not only for the cleaner, but also for water use, cleaner spilled during use, and unused cleaner discarded as residue in each packaging container. This customer also paid fees for special handling, storage, worker training, and reporting on use of the cleaner to comply with laws and regulations. But so far this customer had never measured these costs or connected them with its choice of cleaner.

Seeing an opportunity to work with its customer, the business designed a cleaning “system” to deliver cleaner to customers in one large container, connect it to a hose, mix it with the exact amount of water, and apply it directly to the buses, subways, and train cars. The system would use less water and less cleaner, eliminate handling and storage, and ensure cleaner wasn’t lost as residue in packaging or as “waste” to the environment from spills. By managing all life cycle issues, the system reduces the customer’s costs, manages risks to worker health and safety, mitigates environmental impacts, and provides a longer-term contract for the business.

Life Cycle Assessment (LCA), Design for Environment (DfE), Product Service Systems (PSS) & Integrated Product Policy (IPP) are all responses to the identified need for a paradigm shift in our approach to achieving sustainable development – each builds on the concept of life cycle thinking

Life Cycle Thinking Generates Value & Benefits

Overall, life cycle thinking can promote a more sustainable rate of production and consumption and help us use our limited financial and natural resources more effectively. We can derive increased value from money invested – such as wealth creation, accessibility to wealth, health and safety conditions, and fewer environmental impacts – by optimizing output and deriving more benefit from the time, money, and materials we use.

Experts from industry, government, and other organizations agree that making life cycle approaches part of the way we design products, develop services, make policies, and decide what to consume (or what not to consume) will help to halt and possibly reverse some of the damaging trends in our communities and environments... it certainly won't solve all our environmental problems, but it can help us find sustainable ways to tackle some of them.



“ ... All decisions in government and business should be scrutinized with the ‘sustainability lens’, from a life cycle perspective”

Jacqueline Aloisi de Larderel, Former Assistant Executive Director, UNEP



Did you know?

- Some predict the average global temperature to rise 1°Celsius by 2030, due in part to the greenhouse gases we have already emitted into the atmosphere. Our actions today may in fact be determining the climate for 2050.
- The volume of goods and services we consume and discard is offsetting any improvements in production efficiency that Europeans and North Americans made over the past 20 years (highlight d).^{viii}
- Exposure to hazardous chemicals from the manufacture, use, and disposal of products has been linked to birth defects and cancer in humans, and substances like mercury, chlordane, and DDT are still accumulating in human tissues, in our planet's polar regions and other sensitive ecosystems.
- In 1999, the average person used 2.3 hectares of productive land and sea – considerably more than 1.9 hectares, which is the earth's carrying capacity?^{ix} Our population and our consumption are growing at such a rate that we'll need 4 planets to sustain us by the year 2100.
- The diversity of plants and animals on our planet is decreasing, as is the availability of resources such as timber and freshwater.

Who Is Using Life Cycle Thinking?

The highlights presented throughout this brochure illustrate efforts of several groups, but there are many others currently using a life cycle approach, and more and more are joining them. Especially in developing countries, innovative groups are discovering the life cycle approach as a holistic way to promote social and economic development while respecting our natural environment (highlight I). The fact that governments and prominent global businesses use life cycle thinking – in current operations and in future planning – demonstrates the economic, environmental, and social benefits are tangible.

I) Promoting a Life Cycle Approach in Sustainable Production & Consumption in Eastern & Southern Africa *

The Industrial Ecology Institute, a non-profit organization advocates “the application of life cycle thinking in development activities” as “among the latest important contributions by science in pursuit of sustainable development.” The Institute maintains that industry’s growing acceptance and application of life cycle thinking in many developed countries confirms its potential to strengthen environmental management and policy. “Of significance to Africa is the critical role the approach can play in...sustainable food production, energy security and natural resource management” and there are several reports on the successful use of life cycle assessment (LCA) in forest management, fertilizer and pesticide selection and crop selection in various developed countries. The Industrial Ecology Institute is a pioneer in research, development and capacity building.

What Can I Do?

There is a lot that you can do as an individual choosing to buy a product or service; as an employee involved in manufacturing, procurement, human resources, management, health and safety, finance or marketing; or as a government agent in policy, contracting, or planning:

- Ask questions! Ask where the product you are buying originates, how much energy it uses, what it is made of, and what will happen to it when you are done with it.
- Ask the organization you work for about what it is doing to understand the life cycle of the products and services it makes or buys. Learn how your organization’s decisions influence others along the life cycle of your product or service.
- Talk with others to learn about their experiences and share yours!
- Pilot small projects that use life cycle thinking within your organization or community.
- Write and speak publicly about the projects in your organization or community. Use clear, simple language and avoid terminology and jargon. Describe what you did, the benefits, and what you found difficult so others might adapt your experience to their situation.
- Contact UNEP’s Life Cycle Initiative, to ask for more information – email us at sc@unep.fr.
- Join the Life Cycle Initiative Network – visit www.unep.org/sustain/lcinitiative to find out how.



UNEP DTIE

UNEP Division of Technology, Industry and Economics helps decision-makers in government, local authorities, business and industry develop and implement policies that:

- Promote sustainable consumption and production;
- Encourage efficient use of energy;
- Ensure adequate management of chemicals;
- Incorporate environmental costs.

UNEP DTIE activities focus on raising awareness, improving the transfer of information, building capacity, fostering technological cooperation, partnerships and transfer, improving understanding of environmental considerations into economic policies, and catalyzing global chemical safety.

Find more information about UNEP DTIE at <http://www.uneptie.org/>

SETAC

The Society of Environmental Toxicology and Chemistry (SETAC) is a professional society, in the form of a not-for-profit association, established to promote the use of a multidisciplinary approach to solving problems of the impact of chemicals and technology on the environment. Environmental problems often require a combination of expertise from chemistry, toxicology, and a range of other disciplines to develop effective solutions. SETAC provides a neutral meeting ground for scientists working in universities, governments, and industry who meet, as private persons not bound to defend positions, but simply to use the best science available.

Among other things, SETAC has taken a leading role in the development of Life Cycle Management (LCM) and the methodology of Life Cycle Assessment (LCA). The organisation is often quoted as a reference on LCA matters.

Find more information about SETAC at <http://www.setac.org>

UNEP / SETAC Life Cycle Initiative

UNEP and SETAC have established a global life cycle assessment initiative. Among other things, the Life Cycle Initiative builds upon and provides support to the ongoing work of UNEP on sustainable consumption and production, such as Industry Outreach, Industrial Pollution Management, Sustainable Consumption, Cleaner and Safer Production, Global Reporting Initiative (GRI), Global Compact, UN Consumer Guidelines, Tourism, Advertising, Eco-design and Product Service Systems. The Initiative's efforts are complemented by SETAC's international infrastructure and its publishing efforts in support of the LCA community.

The Life Cycle Initiative is a response to the call from governments for a life cycle economy in the Malmö Declaration (2000). It contributes to the 10-year framework of programmes to promote sustainable consumption and production patterns, as requested at the World Summit on Sustainable Development (WSSD) in Johannesburg (2002). Our mission is to develop and disseminate practical tools for evaluating the opportunities, risks, and trade-offs associated with products and services over their entire life cycle to achieve sustainable development.

The programmes aim at putting life cycle thinking into practice and at improving the supporting tools through better data and indicators by hosting and facilitating expert groups whose work results in web-based information systems.

1. The Life Cycle Management (LCM) programme creates awareness and improves skills of decision-makers by producing information materials, establishing forums for sharing best practice, and carrying out training programmes in all parts of the world.
2. The Life Cycle Impact Assessment (LCIA) programme increases the quality and global reach of life cycle indicators by promoting the exchange of views among experts whose work results in a set of widely accepted recommendations.
3. The Life Cycle Inventory (LCI) programme improves global access to transparent, high-quality life cycle data.

Find more information about the UNEP/SETAC Life Cycle Initiative at <http://www.unep/pc/sustain/lcinitiative>.

Partners of the Life Cycle Initiative (since launch 2002)

Sponsoring Partners

National Institute of Advanced Industrial Science and Technology// Japan

Alliance for Beverage Cartons and the Environment

American Plastics Council

PlasticsEurope

CIRAIG/ Government of Canada and Quebec

EcoRecycle, Victoria

FZK Research Centre Karlsruhe / Government of Germany

General Motors

Government of Canada

Government of the Netherlands

Government of Switzerland

International Council on Mining and Metals

Activity Sponsors & Supporting Partners

ABB

Consumers International

Eco Global / Costa Rica

Indian Society for Life Cycle Assessment

International Organization for Standardization

Nordic Council of Ministers

US Environmental Protection Agency

Acknowledgments

This publication has been prepared by Jim Fava and Jennifer Hall from Five Winds International for the UNEP/SETAC Life Cycle Initiative. The (former) members of the International Life Cycle Panel Ana Lorena Quiros (President, EcoGlobal, Costa Rica), Christian Kornevall (Senior Vice President, Sustainability Affairs, ABB), Jacqueline Aloisi de Larderel (former Assistant Executive Director, UNEP), and Teresa Presas (former President, ACE) provided valuable input.

The first drafts of the document were reviewed by Guido Sonnemann of UNEP DTIE who had the operational responsibility for this publication. The editorial board of the production comprised Fritz Balkau, Bas de Leeuw, and Anne Solgaard of UNEP DTIE. Arend Hoogervorst (Eagle Environmental, South Africa), Damir Subasic (APO Ltd, Environmental Services, Croatia), Hugo Springer (NCPC Brazil), and Marco A. Gonzales (Finanzas Ambientales, Peru) carried out additional reviews.

Financial support for the project was provided by the sponsoring partners of the Life Cycle Initiative: Alliance for Beverage Cartons and the Environment; American Plastics Council; PlasticsEurope (formerly APME); International Council on Mining and Metals; General Motors; Governments of Canada, Germany, the Netherlands, Quebec, and Switzerland; as well as the National Institute of Advanced Industrial Science and Technology Japan, and EcoRecycle Victoria.

The translation from English into French was prepared by Jean-Pierre Artigau and from English into Spanish by Atenea Acevedo.

The design of the publication was done by:
Alex Moyes, Aerographics Creative Services

Images and stories in the brochure were sourced from several publications, including:

- i) MTBE Research at UC Davis. 1998. Online. Available: <http://www.tsrtf.ucdavis.edu/mtbe>
- ii) Lohsomboon, P. *LCA Activities in Thailand*. Business & Environment Program, Thailand Environment Institute, Bangkok Thailand
- iii) For full details visit the *Washright* website or the website of the International Association for Soaps, Detergents and Maintenance Products at www.washright.com and www.aise-net.org
- iv) Proceedings of the International Conference on LCA in Foods, 26-27 April 2001, Gothenburg, Sweden
- v) Integrated Product Policy: Building on Environmental Life-Cycle Thinking. CEC. Brussels, COM(2003) Communication from the Commission to the Council and the European Parliament

vi) This finding is cited from a study conducted by McCann-Erickson WorldGroup. The study is cited in "*Can Sustainability Sell*", published in 2002 by McCann-Erickson and UNEP

vii) McDougall, F. 2003. *IWM Case Studies & The Use of LCA in Countries with Developing Economies*. Slide presentation by Dr. Forbes McDougall of Procter&Gamble

viii) A UNDEP report on Human Development cites a 25% improvement in production efficiency over the past 20 years in Europe and North America, measured as energy efficiency per unit of Gross Domestic Product. UNEP, 1998, Human development report

ix) This Carrying Capacity is calculated according to the Ecological Footprint Approach, by the World Wildlife Foundation, WWF. 2002. *Living Planet Report 2002 – Summary*. Available: www.wwf.org

x) Industrial Ecology Institute, *A Regional Workshop Proposal: Harnessing the Life Cycle Approach in Sustainable Production and Consumption in Eastern and Southern Africa*

xi) Five Winds International. 2001. *Eco-Efficiency and Materials*. Published by the International Council for Metals and the Environment.

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



www.unep.org

United Nations Environment Programme

P.O. Box 30552 Nairobi, Kenya

Tel: (254 2) 621234

Fax: (254 2) 623927

E-mail: cpiinfo@unep.org

web: www.unep.org



**United Nations Environment Programme
Division of Technology, Industry and Economics
Production and Consumption Branch**

Tour Mirabeau, 39-43 quai André Citroën
75739 Paris Cedex 15, France

Tel: +33-1 44 37 14 50 Fax: +33-1 44 37 14 74 Email: unep.tie@unep.fr

Web: www.uneptie.org

DTI/0585/PA