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CIELAP Brief on Life Cycle Assessment
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Life Cycle Assessment (LCA) is a tool that can be used to perform a systematic evaluation of the potential and actual environmental implications of a material, product, package, process, activity or service across all stages of its life cycle. These stages include raw material acquisition, product manufacturing, transportation, sale, use, end-of-life treatment and disposal (i.e. cradle-to-grave or cradle-to-cradle).

LCA can be a valuable alternative or addition to other approaches to environmental issues as it allows decision-makers to consider and address potential unintended environmental consequences that may undermine the potential for a decision to make an overall environmental improvement.

Early forms of LCA emerged in the late 1960s to support corporate environmental strategies. The approach was later used in the 1970s by governments to support the development of public policy. In 1990 the Society of Environmental Toxicology and Chemistry (SETAC) held an international workshop to discuss LCA and the discussions resulted in the document *A Technical Framework for Life Cycle Assessments*. In 1998 LCA was standardized with the approval of the ISO 14040 Standards on Environmental Management – Life Cycle Assessment.

LCA is considered to be a tool that can provide insights into trade-offs associated with environmental pressures and human health and that can complement other social, economic, and environmental assessments. It has been pointed out, however, that LCA should be used as a decision-supporting tool, rather than a decision-making tool, because the LCA process does not fully take into account economic and social impacts or a number of other factors.

CIELAP's briefing on Life Cycle Assessment will provide a discussion about LCA, associated challenges, and how this tool is used in public policy.

Present and historic challenges
LCA can be a challenging and complex process for a number of reasons.

- When it first entered into use LCA was a very time- and resource- intensive process. Its use has since been refined and large public North-America-wide databases have been developed to provide details and support analysis. These databases enable users to track material and energy flows as well as pollution in industrial systems.
- LCA is generally limited to addressing environmental impacts and human health issues and does not aim to address other social or economic aspects. In 2009, however, the UN Environment Programme published *Guidelines for Social Life Cycle Assessment of Products*, which outlines a framework and best practices for assessing

the social and socio-economic impacts of product life cycles. This may become a future priority for LCA.[1]

- In addition to examining a product's direct life cycle, LCA often considers all of the life cycles of the materials that go into a product. This can be a challenging and very time consuming process.
- A number of challenges question the credibility of LCAs including those that relate to selecting appropriate boundaries for a study (what processes should be included and excluded), acquiring quality data, developing appropriate definitions, and many other aspects that speak to putting workable boundaries around complex systems. ISO standards have helped to address these challenges by establishing a consistent methodology for conducting LCAs and reporting results.[2]
- Results strongly depend upon the uniqueness of each local environment and context making it difficult to extrapolate or generalize them to other situations.
- A major underlying challenge is that LCAs are assumed to be purely objective. Their quality, however, depends on the quality of the data used, the assumptions made, the boundaries set, and the biases involved. Also, many concerns that cannot be quantified are left out of LCAs and uncertain effects that cannot be proven are often not included in the assessment.[3]
- The emphasis on numerical outcomes and technical procedures makes the results appear as facts that cannot be disputed or discussed in decision-making. These numbers and technical details be disempowering to members of the public.

Use of LCA to support decision-making

LCA is commonly used by businesses as an environmental management tool to help them reduce negative environmental impacts across the entire life cycle of their products and services. LCA can be used by businesses to:

- Advance design for environment initiatives as LCAs can facilitate decision-making and can help track improvements relating to materials, technology, and design that may enhance desirable traits including increased recyclability or reducing energy use
- Improve the competitiveness of products and communicate advantages to consumers and government bodies.

LCAs support big-picture thinking and encourage upstream and downstream trade-offs to be considered in decision-making. They can be used by all sectors including governments, businesses, institutions and non-government organizations to:

- Identify opportunities to improve the environmental aspects and performance of products at various stages of their life cycle
- Assist in strategic planning and priority setting
- Benchmark options and compare the environmental performance of products, processes or technologies

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[1] Guidelines for Social Life Cycle Assessment of Products (2009). Published by United Nations Environment Programme. http://lcinitiative.unep.fr/default.asp?site=lcinit&page_id=A8992620-AAAD-4B81-9BAC-A72AEA281CB9.

[2] John Reap, Felipe Roman, Scott Duncan & Bert Bras. "A survey of unresolved problems in life cycle assessment". *International Journal of Life Cycle Assessment* (2008) 13:374–388.

[3] Remke M. Bras-Klapwijk. "Are Life Cycle Assessments a Threat to Sound Public Policy Making?". *International Journal of Life Cycle Assessment* (1998) 3 (6):333- 342.

- Facilitate purchasing investments
- Inform stakeholder consultations
- Develop public policy such as setting criteria for eco-design.

Use of LCA to support the development of public policy
LCA has been frequently used by decision-makers across the European Union, Japan, Australia, and many other countries to inform public policy. A 1996 survey of the use of LCA for establishing public policies suggested that policy makers use LCA to develop three different types of policies:

- Product-oriented policy (eco-labelling and purchasing programs)
- Waste management policy (used to determine whether specific materials should be recycled or disposed of and what targets should be)
- Process-oriented policy (using life cycle approaches to develop policy that goes beyond end-of-pipe approaches and looks at the whole picture; such applications include toxic substance management, alternative fuels, and climate change).[4]

Below are two examples of how LCA has been integrated into and used in public policy in the European Commission:

The European Commission's Thematic Strategy on the prevention and recycling of waste (COM (2005) 666) was adopted by the European Commission on December 21, 2005 to promote a recycling society that avoids waste and minimizes the use of resources. The strategy is built on the life cycle approach. It seeks to integrate the many policies and instruments that impact products over the course of their life cycles to encourage greener products to be placed on the market. Such policies and instruments include producer responsibility mechanisms, public purchasing, eco-design, and information campaigns. The strategy recognizes that waste prevention measures and actions must be holistically considered so that perverse effects are not created elsewhere in a product's life cycle.

The European Commission's Integrated Public Policy (IPP) (COM 2003) 302) was adopted on June 18, 2003 with the intention of reducing the negative impacts of products throughout their life cycle. The policy prioritizes life cycle thinking and seeks to achieve its objective by making the existing tools that cover different products more coherent, expanding the tools available, and focusing on products that have the greatest potential for environmental improvement. Specifically the commission has set out promote the use of policy mechanisms such as environmental taxes, voluntary agreements, and green standards; encourage life-cycle thinking and expand the tools available for stakeholders; and focus on tools that provide consumer knowledge including encouraging greener public and corporate procurement and expanding labeling initiatives.

An initial stage of the policy sought to determine what products have the greatest potential for environmental improvement. A study led by the Institute for Prospective Technological Studies (IPTS) concluded that products from three areas of consumption were responsible for 70-80 percent of environmental impacts of private consumption: food and drink, private transportation, and housing. These three products have become a focus for future activities.

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[4] Mary Ann Curran. "Life-Cycle Based Government Policies: A Survey". *International Journal of Life Cycle Assessment:* (1) 39-43 (1997).

CIELAP's Perspective on the use of LCA to support public policy
CIELAP's reports have frequently called on governments to use LCA for the establishment of strong environmental policy. Over the past 10 years these reports and recommendations have included:

An Options Paper on Ontario's Review of the Waste Diversion Act (2009). "The *WDA* should adopt a full lifecycle approach to waste management" and "the *WDA* [could] extend beyond governing waste diversion to regulate other environmental consequences of product design, in accordance with a full lifecycle approach, such as: energy use and the related greenhouse gas emissions; emissions that result from the breakdown of waste in landfills; water use; pollutants; and other consequences."

Update on a Framework for Canadian Nanotechnology Policy: A Second Discussion Paper (2008). "more work is needed now to prepare for regulatory approaches for the next generations of medical and nano-bio devices, likely under other regulatory or licensing regimes. Life cycle analysis of products, including medical devices and pharmaceuticals, should be part of those regulatory assessments, as well as CEPA's evaluation. Producer responsibility should be embedded in all regulatory approaches.

Waste Bytes! Diverting Waste Electrical and Electronic Equipment in Ontario (2008). "Although the report primarily considers WEEE management at the end of a product's useful life, product management must be thoroughly considered at each stage of the life cycle."

Ontario's Waste Management Challenge – Is Incineration an Option? (2007). "The Ontario government should make use of life cycle analysis methods to consider all of the environmental, economic and social costs implicit in the various options for managing waste."

Comments on the Commission for Environmental Cooperation Discussion Paper on the 1998 Taking Stock Report (2000). "It will be important that the CEC examine the full supply chain in the vehicle manufacturing sector, rather than just final assembly plants. Significant use, generation and release of toxic substances may occur in parts manufacturing and processing. The releases and transfers resulting from these activities need to be considered in order to provide a complete picture of the sector. Releases and transfers of pollutants from vehicle recycling, disassembly and wrecking yards should also be analyzed to provide a full life-cycle picture. In future years, consideration should be for studies of other specific sectors. The electricity generation sector may be a particularly appropriate subject for such a study, given the introduction of competition into the sector in Canada and the United States. The mining sector may also warrant attention."

CIELAP supports the use of LCA as a tool that can help determine a fuller picture of the potential environmental consequences of decisions and actions. CIELAP supports further exploration about how it has been used in the past and how it could be appropriately used in the future to advance sound environmental decision making.

For More Information
Industry Canada has developed a long list of programs, initiatives and resources related to LCA: http://www.ic.gc.ca/eic/site/ee-ee.nsf/eng/ef00036.html

This brief is one of seven policy briefs prepared by CIELAP in the spring of 2009. CIELAP's other briefs and publications can be found on the CIELAP website at www.cielap.org.