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Environment, Health and Safety Committee Note on: Life Cycle Assessment

Life Cycle Assessment is potentially the most important method for assessing the overall environmental impact of products, processes or services. It is also sometimes referred to as Life Cycle Analysis or LCA.

1) WHAT IS "LIFE CYCLE ASSESSMENT"?

Life Cycle Assessment (LCA) is a tool for assessing the environmental impacts of a product, process or service from design to disposal i.e. across its entire lifecycle, a so called cradle to grave approach. The impacts may be beneficial or adverse. These impacts are sometimes referred to as the "environmental footprint" of a product or service.

LCA involves the collection and evaluation of quantitative data on the inputs and outputs of material, energy and waste flows associated with a product over its entire life cycle so that the environmental impacts can be determined.

In order to carry out an LCA it is necessary to:

- compile an inventory of relevant inputs and outputs;
- evaluate their potential environmental impacts;
- interpret the results of the inventory and impacts in relation to the specific objectives of the study.

The LCA for a product is a summation of the impacts of:

- extraction of the relevant raw materials
- refinement and conversion to process materials
- manufacturing and packaging processes
- transportation and distribution at each stage
- operation or use during its lifetime
- at the end of its useful life, final transportation, waste treatment and disposal.

Any recycling or recovery operations built into the life cycle should lead to a proportionate reduction in the adverse environmental impact.

From the above, given that there is sufficient data available on the various phases of any given product, process or service, it should be possible to define the LCA fairly precisely for a given location. However, LCA is primarily intended for comparing the life cycles of alternative processes designed to achieve similar objectives in order to discover which of them is the most environmentally sound.

Moreover, since individual resources can have greater or less importance for political or geographical reasons, the resultant LCAs can lead to different conclusions. For example when considering a raw materials extraction phase, the environmental impacts of manufacturing the extraction equipment could also be taken into account. Whether or not it is necessary to do so

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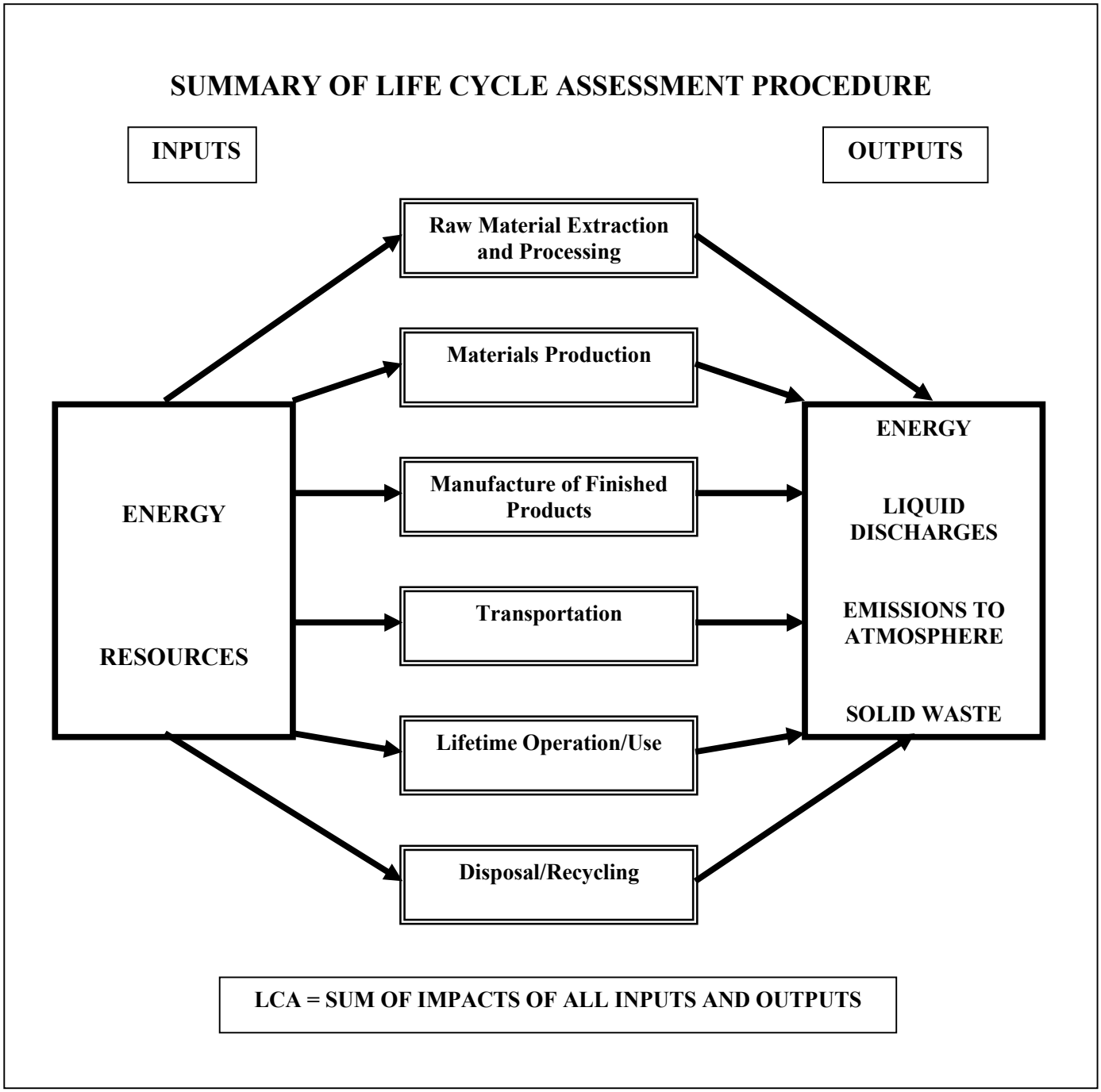
depends on the aims of the particular LCA being undertaken and the uses to which it will be put. Clearly before taking any decisions following LCA, it is necessary to consider the objectives for which it was designed and the boundaries placed around it.

The LCA is summarised in the diagram below, numerical values can be ascribed to the inputs and outputs, the sum of which provides an assessment score.

The government funded Envirowise has published an introductory guide to the principles of LCA which is available free of charge (see Further Reading for details).

Life Cycle Thinking (LCT)

LCT also considers a product's life-cycle and aims for a reduction of its cumulative environmental impacts. This approach is more qualitative and does not require the thorough data analysis that full scale LCA relies on. Considering the life cycle of a product in a general way may lead to implementation of simple measures with great benefits to the environment e.g. reducing packaging of products, or using recyclable raw materials.



2) WHY TAKE THE TROUBLE TO DO A LIFE CYCLE ASSESSMENT?

LCA can help to identify ways to reduce environmental impacts and make cost savings. LCA can also be used to assess compliance with environmental legislation. It is possible to see LCA as part of a more general trend towards improving systems for assessing many types of risk (e.g. risk assessment for occupational risk). The need for a better way of assessing the overall environmental effects of products, processes and services is widely recognised as is the need to limit pollution and the drain on natural resources. LCA provides a means for carrying out such assessment. Its precursors were the Global Modelling Studies and Energy Audits of the late 1960's and early 1970's, which attempted to assess the resource costs and environmental behaviour implications of different patterns of human behaviour.

In the developed world in particular, governments are using a variety of means to try to reduce adverse effects on the environment. One approach to reducing the environmental impacts of purchased goods is to award "badges of acceptance" to items that are made, and operate in, an environmentally sound manner. The hope is that consumers will choose such products over those that are less 'environmentally friendly'. In the European Union the 'badge of acceptance' is called an “Eco-Label” and LCA provides the basis for deciding whether a product should be awarded an “Eco-Label”.

In addition companies that wish to gain a competitive edge, by successfully achieving an environmental management certification e.g. BS EN ISO 14001, may choose to carry out LCA on their processes, to identify the most environmentally damaging components as part of a continuous improvement programme.

LCA and LCT are tools that can be used to assess the environmental impacts of products and services throughout their life cycle and identify ways to reduce these impacts. Other tools to reduce or eliminate impacts include Environmental Management Systems and Environmental Labelling Schemes. These tools form part of the European Commission’s strategy for the implementation of Integrated Product Policy (IPP). IPP is an approach which aims to reduce the environmental impact of products throughout their life cycle. IPP is one of the priorities of the European Commission and part of the European Union’s commitment to Sustainable Development.

LCA and LCT are universally applicable to all sectors, products and services and can benefit all business. Conserving raw materials, saving energy and reducing waste will ultimately not only benefit the environment but also improve the economic efficiency of a business.

3) HOW DO WE CARRY OUT A LIFE CYCLE ASSESSMENT?

In general, if a comparative system is to have any credibility, the product ideally must use some sort of numerical score. This has been the approach adopted by all LCAs. The final assessment scores are used to make judgements about the environmental acceptability of competing processes etc.

> *For energy, water and resource consumption, scoring is a fairly straightforward exercise, but allocating numerical values to pollutant effects is far from straightforward. Therefore at some stage in reviewing the results of the LCA it becomes necessary to make value judgements, as for example, which of two disparate adverse impacts is the more “acceptable” or where the reduction of one impact may increase another or even generate another.*

4) WHAT IS THE WAY FORWARD FOR LCA?

LCA is not a purely objective process. It involves value judgements. Examples might be deciding which is more acceptable:

- an acidic emission or a particular toxic emission
- greater energy demand or greater water consumption
- using a well managed landfill site or incineration
- heavy metal discharges or using chlorinated organic solvents.

What is “acceptable” clearly raises very complex and difficult questions. A decision as to whether something is acceptable may well depend upon the aims and objectives of the person or persons concerned. Certain schools of thought maintain that insufficient attention is paid in LCA to the effects of various processes upon biodiversity. “Acceptability” may vary from place to place and from time to time.

For example an LCA for a process in one part of the world may reach different conclusions to that for a virtually identical process elsewhere depending on the perceived or actual environmental threats in each area.

The great value of LCA lies in the fact that any value judgements involved are clearly identified and transparent. It demands the examination of each and every phase in the "life" of the product, process or service under investigation. There must be no preconceptions if the exercise is to provide a realistic assessment.

Selective or abbreviated LCAs can be devised to evaluate specific components of a product or process but these can be misused to reach pre-determined conclusions, e.g. in support of spurious "green" claims for advertising purposes. For this reason the British Standards Institution, in collaboration with the International Standards Organisation, has published an LCA standard. In addition the United Nations Environment Programme and the Society for Environmental Toxicology and Chemistry (SETAC) have introduced the Life Cycle Assessment Initiative with the dual aim of putting life cycle thinking into practice and improving the supporting tools through better data and indicators.

Some LCA studies attempt to aggregate various environmental impacts into clearly defined categories such as ozone layer depletion, contribution to acid rain and effects on biodiversity. However, reliable methods for aggregating global data generated by LCA do not yet exist. The most widespread uses for LCA other than Eco-Labelling may well prove to be in addressing alternative processes which are under close control, such as those within industry. In these circumstances: energy and resource balances are well defined and scored accordingly; emissions and discharges can be measured and both monetary and environmental costs of elimination and abatement more easily assessed. Irrespective of the application however, the results of LCAs will only be as effective in protecting the environment as the accuracy of the data with which they have been compiled. This means that the exercises must be reviewed at periodic intervals as new data becomes available to ensure that the decisions retain their validity.

The Environment Agency, together with European partners, has developed a website funded by the European Commission called “EcoSMEs” where small businesses can find information and tools to support the undertaking of LCA for their own products and services.

Further Reading

Life Cycle Assessment-An Introduction for Industry (ET257), Envirowise (www.envirowise.gov.uk; Telephone: 0800 585794 for a free copy)

Essentials of Environmental Management, P Hyde, P Reeve, Second Edition, IOSH, Chapter 2 “Tools for Environmental Assessment and Review” 2004

BS EN ISO 14040:2006 "Environmental management. Life Cycle Assessment. Principles and Framework". (see also BS EN 14044: 2006)

EcoSMEs website http://www.ecosmes.net

UNEP/SETAC Life Cycle Initiative http://lcinitiative.unep.fr

RSC EHSC Note Environmental Management Systems, March 2006

RSC EHSC Note Risk Assessment and Work, July 2007

RSC EHSC Note Environmental Risk Assessment, June 2008

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