COMPARATIVE LIFE CYCLE ASSESSMENT OF INCANDESCENT LAMPS AND COMPACT FLUORESCENT LAMPS AND ITS USE IN MANAGERIAL DECISION ANALYSIS

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OPERATIONAL RESEARCH

L P L Chithrage
Department of Mathematics
Faculty of Engineering
University of Moratuwa
Sri Lanka

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DECLARATION

I hereby declare that this project report titled "COMPARATIVE LIFE CYCLE ASSESSMENT OF INCANDESCENT LAMPS AND COMPACT FLUORESCENT LAMPS AND ITS USE IN MANAGERIAL DECISION ANALYSIS" is absolutely my own work and has never been produced earlier so far.

Signature : *UOM Verified Signature*

Name of the candidate : L P L Chithrage

Registration no. : PG/OR/23/2000

I assure that out of the best of my knowledge, that the information given is true and correct.

UOM Verified Signature

Mr. V. R. Sena Peiris
(Project Supervisor)
Director,
National Cleaner Production Centre, Sri Lanka.

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ABSTRACT

COMPARATIVE LIFE CYCLE ASSESSMENT OF INCANDESCENT LAMPS AND COMPACT FLUORESCENT LAMPS AND ITS USE IN MANAGERIAL DECISION ANALYSIS

Comparative life cycle assessment of incandescent bulbs and compact fluorescent lamps(CFL) was made in Sri Lankan perspective to assess the environmental performance of the two product systems throughout life cycle stages from raw material processing; through manufacturing and assembly, distribution, use and to disposal. Impact categories of global warming, acidification, eutrofication, human toxicity, and ecotoxicity were taken into consideration in this assessment. Most of the emissions occur during the usage of both product systems due to the emissions from electrical power generation. The study shows that incandescent lamps causes for most of the emissions compared to CFLs. Life cycle assessment scores finally figured out to be 1.38E-05 for the incandescent lamps and 3.42E-06 for CFLs, which shows that CFLs are 4 times environmental friendly than incandescent lamps.

Subsequently, life cycle scores were used in managerial decision making to come to a logical conclusion of choice between two alternative product systems balancing with social and economic considerations such as investment cost, operating cost, replacement due to early failure and maintenance cost, accidents due to disposal, heating effect, and health impact due to Mercury. Final conclusion arrived after having being introduced different values of choice for each criterion was that still CFLs are preferred by approximately 30% over the incandescent lamps.

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GLOSSARY

Category endpoint: Attribute or aspect of natural environment, human health or resources, identifying an environmental issue of concern.

Characterization factor: Factor derived from a characterization model which is applied to convert the assigned LCI results to the common unit of the category indicator.

Environmental mechanism: System of physical, chemical and biological processes for a given impact category, linking the LCI results to category indicators and to category endpoint.

Functional unit: Quantified performance of a product system for use as a reference unit in a life cycle assessment study

Impact category: Class representing environmental issues of concern to which LCI results may be assigned.

Life cycle: Consecutive and interlinked stages of a product or service system, from the extraction of natural resources to the final disposal

Life cycle Assessment: A systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life cycle.

Life cycle impact category indicator (category indicator): Quantifiable representation of an impact category.

Life cycle inventory analysis results (LCI results): Outcome of a life cycle inventory analysis that includes the flows crossing the system boundary and provides the starting point for life cycle impact assessment.

Unit process: Smallest portion of a product system for which data are collected when performing a life cycle assessment.

Sources: ISO 14040:1997, International standard on Environmental management – Life cycle assessment – Principles and framework.
ISO 14042:2000, International standard on Environmental management – Life cycle assessment – Life cycle impact assessment.

ABBREVIATED TERMS

ADI	-	Allowable dose intake
E	-	Exponential
EL	-	Environmental load
ETP	-	Eco toxicity potential
FU	-	Functional unit
GWP	-	Global warming potential
IIASA	-	International institute for applied systems analysis
IPPC	-	Intergovernmental panel on climate change
ISO	-	International organization for standards
LCA	-	Life cycle impact assessment
LCI	-	Life cycle inventory analysis
LCIA	-	Life cycle impact assessment
NP	-	Nutrification potential
PEC	-	Predicted environmental concentration
PNEC	-	Predicted no-effect concentration
RIVIM	-	National institute of public health and environment
SE	-	Sensitive eco system category indicator
USES	-	Uniform system for the evaluation of substances
VOC	-	Volatic organic compound
YLL	-	Years of life loss