LCAT from LCAnalytics for Environmental Impact Assessment of Computers

Case Study: Environmental Impact of Integrated Circuit (IC) Chips

LCAnalytics

The growing use of computers and electronics is a significant environmental concern. Manufacturers and consumers are increasingly conscious of their impact on the environment; however, no tool exists to accurately model the environmental impact of personal computers and components. LCAnalytics is a company that provides accurate and easy-to-use tools to fill this need.

LCAT

LCAnalytics tool, LCAT, provides:

- Accurate assessment of a computer's impact on global warming, human health, and nature.
- High precision estimates based on component-level analysis.
- Estimates based on more accurate assumptions than existing models, which only use industry-wide averages.

The development of LCAT was based on:

- Professional disassembly, material and process analysis of computers and components.
- Review of recent literature and documentation.
- Correlation of product manufacturer specifications with environmental impact.
- Industry-standard LCA software, including the Ecoinvent database.
- ISO 14000 series requirements

Team

The team at LCAnalytics consists of experts from academia and industry with a passion for the environment:

Shiva Nanda of Newport Computers, Professor Venky Venkatachalam of University of New Hampshire, and Dr. Samudra Vijay of Sam Analytic Solutions, they are assisted by Michael Ernsting, majoring in environmental engineering at Tufts University and Christopher Schwab majoring in business administration at the University of New Hampshire.

Case Study: IC Chips

Chip Packaging

The process of determining environmental impact of IC chips in previous studies was based on categorizing IC chips into either the logic-type or memory-type. Logic-type chips, such as the CPU, were assumed to have Ball Grid Array (BGA) packaging, and memory-type chips were assumed to have PLCC (Plastic Leaded Chip Carrier) packaging. These assumptions, while accurate in some instances, do not account for newer, more space-efficient technologies that are becoming more prevalent. LCAT includes technologies such as a) Land Grid Array chips; and b) chip packages with different chip-to-die size ratios than the PLCC chip.

Electricity Mix

The previous life cycle analysis studies use an entirely European electricity mix, which is not an accurate representation of the energy mix used to create these computer components, since most of these are fabricated in Asia. LC Analytics uses a geographic-region specific electricity mix based on the location of manufacture of the components.

Die Size and Mask Layers

One of the several factors used in the computation of energy input for IC chip fabrication is the die size of a chip. The die, cut from a silicon wafer, is the most complex part of the chip and requires the most energy to manufacture. Chip housings have different die size ratios. Another factor contributing to the energy input estimates is the number of mask layers applied to the wafer during processing. The number of mask layers can be directly correlated to the number of pins or leads on a chip. Both these factors are included in LCAT.

life cycle analytics

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