Program for system development to support the construction of a Sound Material-Cycle Society

Evaluating societies by analyzing material and energy flows

Material Flow Analysis (MFA), which is sometimes referred as Material Balance Analysis, is a comprehensive and quantitative methodology for examining the input-output balance of materials through a particular system, in which inflows such as energy and material resources are transformed into outflows such as products, by-products, and wastes. MFA focuses either on entire flows of various materials or on a particular flow of a specific material or substance.

One area of active research is national economy-wide MFA. In one example, 5 countries (initially 4 countries)—Japan, the United States, and a few countries from the European Union jointly launched international comparison research and several European states are in the process of implementing MFA in order to evaluate their society's impact on the environment. MFA has been very useful in answering critical social questions about "hidden material flows", which are generated by mining processes that create huge volumes of by-products such as sand and rock.

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Life Cycle Assessment (LCA)

LCA was originally developed as a method to evaluate the overall environmental impact caused by a product's "function". In recent years, LCA has been used evaluate waste disposal technologies and resource recycling technologies. These LCAs focus either on products for disposal or recycling, or on waste disposal and recycling technology (or, more specifically, on the services that is provided by these technologies). LCAs have been conducted on a wide range of products, technologies, and systems.

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Program for Sound Material-Cycle design and production

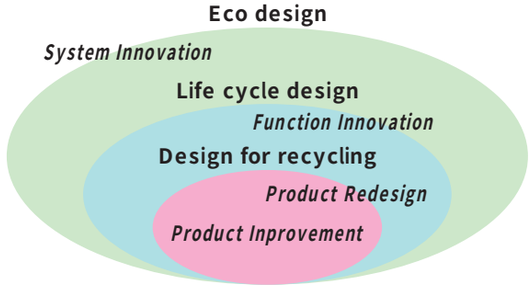
From Design for Recycling to Life Cycle Design

In its narrowest sense, eco-design means designing man-made artifacts such as products and buildings so that they are in harmony with the environment. Various labels are given to the process, including environmentally compatible design, environmentally friendly design, and Design for Environment (DfE). In the past, eco-design focused on producing products that were easily disassembled, selecting materials that were easy to recycle, and properly labeling the materials. This can be termed "design for recycling". However, such designs focus only on recycling, which may result in mass production and large-scale recycling. The next, more advanced generation of eco-design is "life cycle design". Such design is based on the "life cycle" concept and the idea of Sustainable Services & Systems (3S). These designs aim to improve the level of service and reduce the environmental burden throughout the entire life cycle.

Concept of "Circular Manufacturing"

Another important issue is the development of technology for manufacturing and reverse manufacturing, which together drive circular manufacturing. The concept of "zero emissions", has spread widely, significantly reducing the amount of waste at the individual business level. A large part of this is attributable to management technologies such as environmental monitoring systems. A large proportion of the cost associated with reverse manufacturing is caused by the collection of used products (also referred to as "reverse logistics" or the "reverse supply chain".) Therefore increasing the efficiency of this reverse logistics is also a major issue.

Design for recycling, life cycle-based design, and eco-design



Design at each material level in the social system