# Integrating environmental aspects into product design and development

BY DR. KUN-MO LEE

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All products, including services, have some impact on the environment and this may occur at any or all stages of the product's life cycle – raw material acquisition, manufacture, distribution, use and disposal. These impacts may differ in magnitude, temporal and geographical boundaries. It is now commonly accepted that products are the major cause of today's environmental pollution, as well as the depletion of resources.

The interest of various stakeholders in the environmental aspects and impacts of products is increasing. This interest is reflected in discussions among business, consumer, governmental and nongovernmental organizations concerning sustainable development, design for the environment, trade measures, and government or sector-based voluntary initiatives. This interest is also reflected in the economics of various market segments that are recognizing and taking advantage of these new approaches to product design. These new approaches may result in improved resource and process efficiencies, potential product differentiation, reduction in regulatory burden and potential liability, and costs savings.

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More organizations are coming to realize that there are substantial benefits in integrating environmental aspects into product design and development. Some of these benefits may include: lower costs, stimulation of innovation, new business opportunities, and improved product quality.

The new ISO technical report, ISO/TR 14062, *Environmental management – Integrating environmental aspects into product design and development*[1], describes concepts and current practices relating to the integration of environmental aspects into product design and development.

The technical report is intended for use by all those involved in the design and development of products, regardless of organization type, size, location and complexity, and for all types of products, whether new or modified. It is written for those directly involved in the process of product design and development and for those responsible for the policy/decision-making process.

This technical report is not intended for use as a specification for certification purposes. However, it can be used in developing sector-specific documents

## Holistic approach

One of the most prominent features of ISO/TR 14062 is the holistic approach to integrating environmental aspects of products in the existing product design and development process. Considering not only product issues, but also strategic and management issues in integrating environmental aspects is the key to the success of the integration process. This technical report adopts the holistic approach by specifically addressing issues related to strategic, management and product considerations.

### *Strategy*

Strategic considerations involve organizational, product, and communication issues within the context of

1) The major part of this article is drawn from ISO/TR 14062, which was developed by the experts of Working Group 3 of ISO technical committee ISO/TC 207, *Environmental management*, whom the author acknowledges for their dedication and professionalism, and the secretary of WG 3, Ms. Corinne Del Cerro (France), for her work in compiling comments and managing the project.

the organization's existing policies, strategies and structure. Examples of the organizational issues include competitors' activities and customer needs. Examples of the product-related issues include early integration, life cycle thinking and functionality. Examples of communication issues include internal and external communications.

### *Management*

Management considerations involve the consideration of the management role, proactive approach, existing management system support, multidisciplinary approach, and supply chain management.

Management roles include the initiation of the integration process, either top-down or bottom-up. A proactive approach seeks to prevent adverse environmental impacts before they arise. Support from existing management systems such as quality and environmental management systems can activate the integration activities. In general, the product design and development process is usually part of an existing management system, such as ISO 9001, through which the environmental aspects and product-related activities could be incorporated.

**There are substantial benefits in integrating environmental aspects into product design and development**

The multidisciplinary approach involves relevant disciplines and organizational functions such as design, marketing and environment. Supply chain management deals with interactions with suppliers, carriers, customers, retailers, and end-of-life actors.

### *Product*

Product considerations involve the consideration of the product-related environmental aspects and impacts, basic issues and strategic environmental objectives. Possible design approaches are the actual means to meet the strategic environmental objectives.

### *Product-related environmental aspects and impacts*

Products may have a range of environmental aspects (e.g. emissions generated) that result in environmental impacts (e.g. air pollution). The environmental impacts are largely determined by the material and energy inputs and outputs generated at all stages of a product's life cycle.

### Basic issues

Early integration, product life cycle, functionality, multi-criteria concepts, and trade-offs are common basic issues for the integration process. Early integration literally means integration of environmental aspects as early as possible into the product design and development process. Product life cycle approach is used to identify the relevant environmental aspects and impacts during the entire product life cycle.

Functionality thinking (how well the product suits the purpose for which it is intended in terms of usability, useful life time, appearance, etc.) may lead to a solution that has a reduced environmental impact when compared with traditional solutions only based on goods.

Multi-criteria concepts such as a reduction in product weight or volume may reduce the environmental impacts of the product. For example, a reduction in product weight or volume may be the result of optimizing material use, thereby reducing impacts associated with resource depletion. It could also decrease shipping weight or volume, thereby reducing emissions associated with transport.

Trade-offs are associated with most design decisions. There are

three types of trade-offs between:

– different environmental aspects;
– environmental, economic and social benefits, and
– environmental, technical and/or quality aspects.

## Strategic environmental objectives

There are two strategic environmental objectives. One is the conservation of resources, recycling and energy recovery, and the other is the prevention of pollution, waste and other impacts. The first objective is to optimize the use of resources required for the product (material and energy) without having an adverse effect on its performance, its durability, and so on.

The second objective is to maximize environmental improvements by using measures that prevent pollution, waste or other impacts. Such approaches deal with problems at their source, considerably reducing the causes of environmental impact and the costs associated with the end-of-life treatment.

## Possible design approaches

An organization may decide upon a combination of design approaches to meet the strategic environmental objectives. Examples of possible design approaches include improvement of materials and energy efficiency, and design for durability, etc.. These design approaches are instrumental in generating design options that can be checked against the feasibility and potential benefits for stakeholders.

## Product design and development model

A generic model of product design and development in ISO/TR 14062 consists of six stages: planning, conceptual design, detailed design, testing/prototype, market launch, and product review.

The planning stage encompasses planning and formulation of product requirements. The conceptual design stage is for defining the requirements for the product. The detailed design stage is for meeting the product design specification and specifying the product prior to production or introduction into service.

The testing/prototype stage is for checking the detailed design against environmental targets and other specifications. The environmental performance of the product such as life cycle assessment results can also be assessed in this stage. The market launch stage consists of delivering the product to the market and communicating information on the product's features and benefits to the customers.

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The product review aims at finding out whether the expectations of the organization, customers and other stakeholders have been met. Feedback and criticism from customers and other stakeholders are an important information source for the organization to improve its current or future products.

## Application

Increasing awareness of the need for sustainable products will result in the integration of environmental aspects into product design and development. Thus, it is reasonable to assume that ISO/TR 14062 has many applications now and in the foreseeable future.

Current applications include the development of a sector-specific guide in the field of electrical and electronic equipments (EEE). For example, IEC (International Electrotechnical Commission)/ACEA (Advisory Committee on Environmental Aspects) will publish IEC Guide 109, *ACEA Guide on Design for Environment*. This guide has adopted the basic concepts of ISO/TR 14062. On the same lines, it is expected that sector-specific guides in other fields will be developed based on this technical report.

Another application is the potential use of this technical report as a basic framework for a regional or national legal requirement. For example, there is a possibility that ISO/TR 14062 may be referred to as the source of the detailed procedure on ecodesign in the European Union's proposed directive on EEE.

ISO/TR 14062 costs 98 Swiss francs and is available from ISO national member institutes (these are listed with full contact details on ISO's Web site: **www.iso.org**) and from ISO Central Secretariat (**sales@iso.org**).