

ENSURING ECO-EFFICIENCY FOR SUSTAINABLE DEVELOPMENT

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The term eco-efficiency was coined by the World Business Council for Sustainable Development (WBCSD) in its 1992 publication "Changing Course". It is based on the concept of creating more goods and services while using fewer resources.

Strategies that have been linked to eco-efficiency include "Factor 4" and "Factor 10", which call for specific reductions in resource use, "natural capitalism", which incorporates eco-efficiency as part of a broader strategy, and the "cradle-to-cradle" movement, which claims to go beyond eco-efficiency in abolishing the very idea of waste. All versions of eco-efficiency share four key characteristics:

Confidence in technological innovation as the main solution to unsustainability.

Reliance on business as the principal actor of transformation. The emphasis is on firms designing new products, shifting to new production processes, and investing in R&D, etc., more than on the retailer or the consumer, let alone the citizen.

Trust in markets (if they are functioning well).

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To be sustainable organizations must embrace new objectives: optimize operations to minimize environmental impact and improve social outcomes in a manner that also maximizes performance.

No matter what your business is, sustainability is your business. For example, by 2025 buildings will use more energy than any other category of "consumers" (today, in the United States they represent 72% of energy use). In addition, 40% of the world's current output of raw materials goes into buildings. That is about 3 billion tons annually.

Benefits of eco-efficiency refer to increase in economic value with unchanged (or decreased) environmental impact. As indicated in Table 1, four variants of increased eco-efficiency indicators can be defined:

an increase in eco-productivity, i.e., efficiency of environmental impact. A *decrease of nature intensity*, i.e. a decrease of costs of natural factors;

an increase in the efficiency of environmental costs, i.e. better state of the environment per unit of environmental cost;

a decrease in environmental specific costs, i.e. costs per unit of environmental state improvement.

Table. 1 – Four types of eco-efficiency

Ratio	Goal	
	Productivity increase	Environmental state improvement
Economic versus environmental indicators	Total production per unit of aggregate environmental impact costs or <i>environmental productivity</i>	Sum of costs incurred per unit of environmental state improvement indicator (averted damage) or costs of environmental state improvement
Environmental versus economic indicators	Environmental impact indicators (ecological-economic damage) per unit of production or <i>environmental intensity</i>	Improvement of environmental state per unit of costs or <i>environmental cost-effectiveness</i>

Increase in efficiency is one of the key success components in business. Enterprises constantly seek ways to improve their efficiency.

Eco-efficiency (EE) refers to the idea to produce more goods and services using less resources. EE is defined as:

$$EE = P_e / B_n \quad (1)$$

where P_e is the economic result (the additional value of produced net goods, additional profit etc.); B_n - an estimation of the environmental impact (in particular, the amount of consumed natural goods and their monetary value, economic environmental damage).

The basis for evaluating eco-efficiency is the integral material intensity indicator (M_u)

$$M_u = \sum M_i / \sum S_i \quad (2)$$

where $\sum M_i$ is the input of material costs (natural raw materials) in the production process or production chain; and $\sum S_i$ is the quantity of services provided (produced goods). The inverse ratio $\sum S_i / \sum M_i$ is the conditional equation for *natural-resource efficiency* or *eco-efficiency*.

The integral material intensity analysis (or M_u – analysis) allows identifying more effectiveness of goods; in other words *dematerialization* of the economy. This allows addressing environmentally dangerous *outputs* (emissions, discharges, wastes etc. at the end of production process or consumption) in relation to the flow *inputs*.

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