

## **Environmental economics and engineering innovations for Sustainable Development**

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Engineering is applied for the benefit of environment, human society and economic development. On one hand modern advances in engineering have caused some of the environmental problems that plague human society, on the other hand it can help in designing projects, products, and processes that can reduce or eliminate the same threats to environmental integrity. It is therefore imperative to recognize the obligations the engineering profession have towards the environment and how should these obligations be fulfilled.

Engineering codes and environmental laws are beginning to mandate a concern for environment and impose environmental obligations by setting up parameters within which the engineering profession must be practiced. The environmental laws passed in the last few decades in the United States and elsewhere and the environmental statements in engineering codes both reflect a widespread and increasing belief that the human effect on the environment is a cause for concern. Central to this philosophy is the environmental stewardship that provides a basis for professional obligation towards future generations. A major aspect of the engineering response to the environmental challenges is the pursuit of sustainability, especially through life cycle analysis (LCA). This paper focuses on the inclusive environmental concepts of human-centered environmentalism, supportive ecology, and environmental justice.

Sustainable engineering encompasses numerous ways to improve processes and products to make them more efficient from an environmental standpoint. Thus, in sustainable design, engineers must optimize for variables that give the best performance in temporal frames. The three dimensions of sustainability, viz. environmental sustainability, economic sustainability, and social sustainability are intrinsic to each other. Engineers should aim at development in such a way that it meets the needs of the present without compromising the ability of the future generations to meet their own needs.

Engineers use sustainable engineering, efficiency, and environmental economics to design processes and operating systems such that they use the energy and resources efficiently. The natural resources are to be used at a rate that does not compromise with the natural environment or the ability of future generations to meet their own needs. There are three dimensions of sustainability and they overlap each other:

- *Environmental sustainability*: Maintenance and protection of environmental system and natural resources, ensure biodiversity, risk and emission rationing
- *Economic sustainability*: Maintenance and development of the man-made capital stock, economic growth, competition stability, and efficiency
- *Social sustainability*: Maintenance of the social capital stock, education, security, health, human rights, and social justice

Engineering society codes have lately tried to address the conceptual question of the meaning of sustainable development.

Engineering is a tool to develop analytical systems and design techniques to improve the sustainability of products, processes and services by meeting new design criteria focused on the people and the planet as well as for profit. Use of these systems and technologies only from the perspective of maximizing profits becomes counter-productive from environmental point of view as it does not maximize the well-being of the people, if that is our ultimate goal. Engineers continue to raise concern about environmental obligations and sometimes place themselves at odds with the organizations they work for. Engineering codes should have provisions so that professional can put forward their responsible disagreements that they think would be in ultimate interests of all.

As much as the responsibilities for fulfillment of these areas of concerns lie with engineers, government officials, economists, business leaders, and the general citizens need also to be equally involved.