

INDUSTRIAL  
ECOLOGY



MAKE MONEY  
THE GREEN WAY

**THERE IS MONEY IN INDUSTRIAL WASTE**

An urgent challenge facing business today is the need for technical and management approaches that will alleviate global environmental problems and support sustainable industrial growth. Industrial Ecology is a new view of industrial infrastructure that is emerging in response to this challenge.

### WHAT IS INDUSTRIAL ECOLOGY?

Generally, Industrial Ecology is a new and innovative concept that involves restructuring industrial systems to minimize wastes and maximize the cycling of materials and energy. It mimics the closed-loop materials and energy flows found in natural ecosystems, where the output of one organism becomes the input of another.

At the moment, the industrial system is more like a collection of one-way flows -- drawing materials and traditional fuels from nature, processing them for economic

value, and dumping the residue back into nature, otherwise known as the “extract and dump” pattern. Industrial Ecology provides a framework for changing this linear pattern to a closed loop by fusing together the industrial system with the natural ecological system.

Industrial Ecology intends to create a common cause between industry and environmentalism. It is based on these implicit assertions:

- Industrial activities can be in balance with nature.
- Industrial growth with low environmental impact is possible.
- Industrial development can be made sustainable.
- Technology is an expression of fundamental human curiosity and ingenuity, thus affirming both technology and innovation, but allowing technology to be designed for improved social and environmental yield.



*“The traditional model of industrial activity, in which individual manufacturing processes take in raw materials and generate products to be sold, plus waste to be disposed of, should be transformed into a more integrated model; an industrial ecosystem. In such a system, the consumption of energy and materials is optimized and the effluents of one process... serve as the raw material for another process.”*  
- Frosch and Gallopoulos (1989)



- Human activities are not intrinsically “unnatural.”
- Today’s problems can be solved only by future creativity -- there is no way back.

**WHAT’S IN IT FOR ME?**

It enhances industry competitiveness through:

- Reduced operating costs especially in materials, water and energy
- Reduced pre-treatment, transport and off-site disposal costs of liquid, solid, and hazardous waste
- Potential income from the sale of by-products
- Reduced environmental liability and insurance costs
- Improved public image
- Increased employee productivity

***Benefits to society and the environment:***

- Enhanced protection of natural ecosystems, habitats, and landscapes
- More efficient use of resources such as land, water, energy, and other natural resources
- Protection of cultural and archaeological resources

*The ultimate goal of Industrial Ecology is bringing the industrial system as close as possible to being a closed-loop system, with near complete recycling of all materials.*

- Reduced risk to human health and safety from industrial accidents and emission
- Improved health for employees and human communities

**HAS THIS NEW CONCEPT BEEN PUT INTO APPLICATION YET?**

The most famous example of industrial symbiosis is the industrial district of Kalundborg, Denmark.

For more than 20 years, industries have exchanged by-products such as surplus energy, waste heat and other materials.

The Kalundborg district is built up as a network cooperation among four industrial enterprises in the town and municipality of Kalundborg: Asnaes Power Station, the plasterboard manufacturer GYPROC, the pharmaceutical and biotechnology company Novo Nordisk, and the STATOIL refinery trade-by-products. The waste of each is a valuable raw material to one or more of the others. The result is a reduction of both resource consumption and environmental impacts.

For instance, gypsum is recovered from Asnaes power station and is supplied to Gyproc. Or Novo Nordisk's sludge is used as fertilizer supplement for farmland.

### **HOW CAN INDUSTRIAL ECOLOGY WORK FOR MY BUSINESS?**

Specifically, Industrial Ecology works through relationships among company locators who work both individually and interdependently with one another to achieve economic and environmental gains. The exchange of by-products between companies is a way of creating industrial symbiosis or industrial ecosystems. This approach views industry as an interwoven system of production and consumption whereby companies exchange by-products for use as raw materials rather than continually using virgin materials and accumulating waste.

### **HOW DO I GET INTO INDUSTRIAL ECOLOGY?**

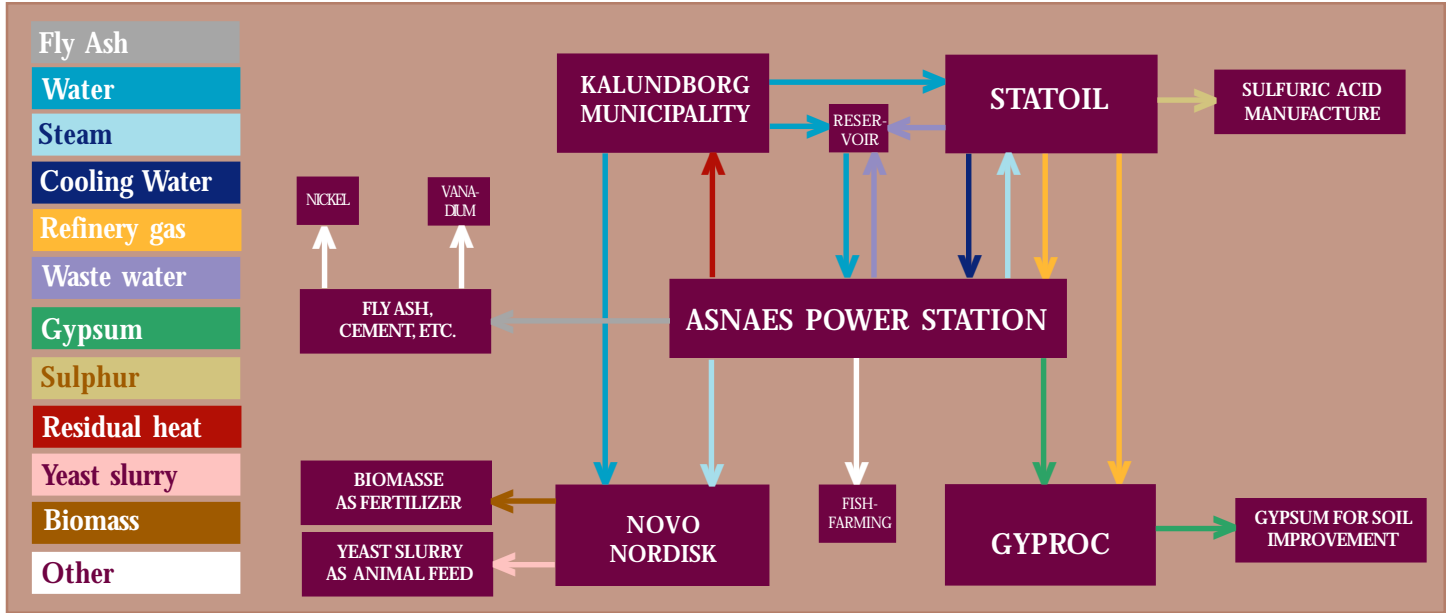
Your company may coordinate with **PRIME (Private Sector Participation in Managing the Environment)**. PRIME Project is a multifaceted program, initiated and funded by

the United Nations Development Programme (UNDP). The project is expected to initiate the introduction of cleaner means of production and adoption of environmental management systems in the business sector. It is directed towards enhancing emerging private sector initiatives in minimizing industrial environmental impacts.

The project has four modules namely, **Business Agenda 21** (Module 1), **Industrial Ecology** (Module 2), **Environmental Management Systems** (Module 3), and **Environmental Entrepreneurship** (Module 4).

The Industrial Ecology module aims to apply principles of the Industrial Ecology in local industrial estates or growth centers, develop policies of the government on the said areas, develop awareness among decision-makers in government and the private sector on industrial symbiosis and its economic benefits, among others.

For more information, you may contact PRIME through 899-5688 / 897-6682 local 300, telefax: 895-8233 or check out the webpage at <http://www.iephil.com>.



A diagram representing the relationship of industrial estates in Kalundborg, Denmark.

If you wish to know more  
 about Industrial Ecology, you may contact  
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