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STRATEGIES FOR BETTER WASTE MANAGEMENT IN INDUSTRIAL ESTATES

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ABSTRACT

Industrial estates are primarily designed to improve production efficiency through the clustering of manufacturing industries and services but most of them are posing a danger to the environment. If environmental concerns are integrated into estate development at all stages, cumulative damaging effects can be avoided. Estates with sound environmental management systems including energy efficiency measures, resource conservation, waste minimization, cleaner production and information centers, and preparedness for accidents prevention can be developed in India also. The industrial district of Kalundborg in Denmark is a novel example of this type of industrial symbiosis. For 15 years, industries on the site are exchanging by-products such as surplus energy, waste heat and other materials. This paper attempts to highlight the latest developments in utilizing industrial wastes of an industry as an industrial inventory for another industry. This paper also highlights the potential of establishment of such industrial symbiosis in Indian manufacturing.

PRESENT STATUS OF POLLUTION

The most serious environmental problems in urban areas are : air, pollution, water pollution, solid waste accumulation and disposal of toxic and hazardous wastes, and the noise. Most urban air pollution comes from the combustion of fossil fuels, in motor vehicles and for industrial processes, heating and electricity generation, but some also comes from incinerators, petrochemical

plants and refineries, metal smelters and the chemicals industry. Some primary pollutants can combine to form even more damaging secondary pollutants, e.g., ozone and other photochemical oxidants are formed when hydrocarbons react with nitrogen oxides and oxygen in the presence of sunlight. Troposphere ozone is one of the major components of urban smog, a growing problem in urban areas throughout the world.

While urban air pollution is coming under control in some countries, the situation is deteriorating rapidly in many heavily industrialized cities in developing countries. In China, for example, smoke and small particles from burning coal cause more than 50 000 premature deaths and 400 000 new cases of chronic bronchitis a year in 11 of its largest cities (World Bank 1997), and private car circulation has been restricted in some cities in South America and Europe in attempts to reduce harmful levels of air pollution.

Worldwide, more than 1 000 million urban residents are exposed to health-threatening levels of air pollution.

Concept of eco - Industrial parks

Increased awareness of environmental issues and increasingly stringent regulations are now pushing estates to look for cost-effective ways to improve their environmental performance. Many small and medium-sized companies, especially in developing countries, cannot afford to design, build and operate their own pollution control systems. For such companies, environmental compliance problems could be handled more easily, and more cost-effectively, by locating in appropriately managed industrial estates.

Over thirty eco-industrial parks are at various stages of development worldwide. The emphasis in each park ranges from resource recovery and reuse centers and green industry clusters, to energy cascading and region-wide materials exchanges. Several parks are already well developed but most are still in the planning and feasibility stages. The formation of eco-industrial parks creates both environmental and economical benefits and is influenced by a number of drivers and barriers.

Environmental benefits

The tangible environmental benefits include :

- Reducing greenhouse gas emissions and toxic air emissions
- Promoting green technology development and diffusion
- Improving energy, materials and water use efficiency and conservation
- Promoting pollution prevention on a system or community basis
- Promoting the redevelopment of brown field industrial sites

Economic benefits from eco-industrial park development are the primary drivers and are shared by participating businesses, governments and communities. These include :

- Generating local employment, particularly from forward looking, innovative firms who will be attracted to eco-industrial park developments

- Retaining existing business
- Increasing tax revenue
- Generating cost savings for participants in the form of reduced waste management, reduced infrastructure costs, and improved process and product efficiency
- Leading to the identification of opportunities for other cooperative ventures such as joint purchasing, combined waste recovery and treatment, employee training, environmental monitoring and disaster response
- Providing new marketing opportunities as in the case of the new "environment label" for industrial parks that meet certain environmental criteria that has been developed and is in use in France.
- Improving opportunities for new investments
- Improving opportunities for new technology development that facilitates greater efficiency of production.

Industrial ecology approach

Industrial ecology also known as "the science of sustainability" is a systems approach to the analysis of the flows of materials and energy considering the life cycle of products, the design of buildings, infrastructure and industrial parks and the reuse, recovery and recycling of resources in a manner which is cleaner and more efficient. The approach recognizes the connectedness of materials, products and infrastructure to ecological functions and services provided by the natural environment.

Objectives of industrial ecology

- Calculation of cost savings and new revenues in existing operations;
- Exploring new emerging markets for existing goods and services;
- Developing new technologies, processes and products;
- Identifying new organizational, legal and economic innovations;
- Developing infrastructures, which encourage exchange, reuse and recycling
- Identifying cumulative effects of production and consumption.

Various examples of eco-industrial park initiative

The World Scenario

Korean national cleaner production center

Korea has launched an ambitious eco-industrial park (EIP) initiative, under the leadership of the Korean National Cleaner Production Center. South Korea has a total of 504 industrial parks, with 35 large national parks or complexes on 2/3rd of the total land for industrial parks (total = 66,635 hectares or 164,440 acres). The six industrial complexes that are pilot projects in the EIP initiative are :

1. Banwol & Siwha in the southern part of the Seoul metropolitan area have a total of 7860 acres, 3180 hectares, with 5,400 small to medium enterprises. Participating industries include textile, dying, pulp & paper, and chemical

plants, small manufacturers and waste incinerators.

2. Mipo and Onsan industrial complexes are in Ulsan (SE Korea) : Mipo covers 9968 acres, 4033 hectares. Prominent industries are automobile manufacturing, ship building, and one of the world's largest petrochemical complexes. Onsan's size is 3765 acres, 1524 ha. Nonferrous metals, steel, and metal manufacturers are the major industries. The two parks include a total of 700 companies.
3. Yeosu in the southern part of Korea has 7736 acres, 3130 hectares and is primarily a petrochemical complex and oil refinery with 149 companies.
4. Cheongju industrial complex has 1010 acres, 410 hectares of land, with 200 companies. Major industries are food, textile, paper-mill, petrochemical, electronics, non-ferrous metals, metal manufacturing and assembly.
5. Three clusters of smaller industrial parks include Machun Industrial Complex at Jinhae, Chilso Industrial Complex at Haman, and Sangpyeong Industrial Complex at Jinju. Jinhae complex is 150 acres or 61 hectares, Haman, 760 acres, 307 hectares and Jinju 528 acres or 214 hectares. The three clusters are around 50 km apart. Most of 550 companies in these locally managed parks are small and medium enterprises. Industries at Jinhae include non-ferrous metal, steel, and machinery and at Jinju, food, textile, pulp, and chemical. Haman if half vacant.
6. Pohang industrial complex has 49,70 acres, 2010 hectares with 220 companies in steel, cement, and waste disposal.

Kalundborg (Denmark) - A novel example of industrial symbiosis

The Industrial Symbiosis co-operation in Kalundborg is unique in the world of today. Only the right composition of companies in a local area may provide the basis of sustainable projects. The more companies involved, the greater the opportunity for symbiosis, and thus the potential for reducing resource consumption and environmental strain. In Kalundborg, the Symbiosis has been built around a network of 8 partners. That explains why the Industrial Symbiosis has aroused international interest from most corners of the world.

The Industrial Symbiosis of Kalundborg is built as a network co-operation between six processing companies, one waste handling company and the Municipality of Kalundborg.

The philosophy behind the Symbiosis is that the six companies: **Energy E2** Asnaes Power Station, the plasterboard factory **BPB Gyproc A/S,** the pharmaceutical plant **Novo Nordisk A/S,** the enzyme producer **Novozymes A/S,** the oil refinery **Statoil A/S, Bioteknisk Jordrens Soilrem A/S** as well as the waste company **Noveren I/S** and **Kalundborg Municipality** - exploit each other's residual or by-products on a commercial basis.

One company's by-product becomes an important resource to one or several of the other companies. The outcome is reduced consumption of resources and a significant reduction in environmental strain.

The guangxi guitang group in China

In China the Guangxi Guitang Group is a notable example of using sugar production byproducts, first within a single city-owned company, and then in a broader network including other sugar producers in the city of Guitang and the farmers growing cane. This success was possible because the first investments in infrastructure and plants were all within a single corporate group, not between separate firms. From this single-company, an eco-industrial network has evolved, including other sugar producers and the farmers growing the sugar cane.

CONCLUSION

Company to company by-products exchange is the only system for full optimization of resource utilization. The Cleaner Production programs facilitate to reduce, reuse, and recycle waste materials within a facility. This strategy will reduce the total volume of materials and products to be managed at the end of the production/consumption cycle.

A vitally important strategy is innovation in product and process design i.e. eco-design to reduce resource inputs per unit of output and to extend the lifecycle of end products through durability, reparability, up-gradability, and re-cyclables. Eco-design plays an important role in German and Japanese Recycling Economy plans.

An eco-industrial park can benefit its whole community by hosting such a cluster of resource recovery companies, as well as other firms promoting cleaner production and design for environment to increase efficiency and productivity of major companies and government facilities. Eco-industrial parks are the need of the time to be established in Indian manufacturing also.

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