Industrial Estates*

Introduction

Environmental regulators have access to a large set of policy tools and instruments to create incentives for industrial facilities to abate pollution. Command and control is one approach where pollution standards for emissions or effluence are set, and fines and penalties are assessed against non-compliant facilities. Other options include pollution charges, tradable permits, voluntary participation programs, as well as environmental performance rating and public disclosure programs. For related information, see the other World Bank Guidance Notes in this series on effective pollution management and World Bank (2000) for reviews of these programs.

Historically, industrial estates have been established to facilitate and promote industrial and economic development. Such regrouping of industrial facilities onto a narrowly defined location offers additional opportunities. These include the chance to improve the facilities’ environmental performance in a cost-effective manner by allowing facilities to share common waste-treatment facilities. Furthermore, such regrouping allows companies to exploit opportunities where one firm’s waste becomes another’s input.

More recently, industrial estates have also been promoted for the explicit purpose of facilitating the relocation of industrial facilities from densely urbanized areas where high land prices may not justify the industrial use of such space, and where populations living in close proximity to industrial firms may be more directly exposed to adverse environmental effects.

While the term “industrial estates” is used to refer to this particular regrouping of industrial facilities, the term “industrial parks” is also used to refer to the same concept. On the other hand, the term “industrial zones” refers to an area of land set aside for industrial facilities without the explicit purpose of facilitating or promoting the provision of common infrastructure and services (UNIDO 1997).

Description and Application

An industrial estate is a specific area (tract of land) that is separated from urban and densely populated areas, and zoned specifically for the location of industrial facilities. Industrial estates must support
proper infrastructure such as roads, power, water supply, and other utility services to all facilities located within the well-defined parameters of the estate.

National and local authorities may support the promotion and establishment of industrial estates by encouraging foreign direct investment, redistributing employment and production away from densely urbanized regions, and accelerating regional development. Industrial estates may attract industrial facilities by offering an attractive package of services (such as power and water) that can be supplied continuously, reliably, and at a cost that industrial facilities could not achieve on their own. This package of services is often complemented with various forms of preferential investment incentives such as exemptions from import or export duties, income tax exemptions, and various other subsidies. Furthermore, industrial estates also generally offer a “one-door” policy aimed at facilitating the licensing and permitting process of new industrial facilities.

In recent years, a small number of industrial estates have proactively promoted trade and exchange among industrial facilities located within the estate, including the trading of waste; such facilities are sometimes referred to as “locators”. This has given rise to the concept of eco-industrial estates (also known as eco-industrial parks). Based on the principles of industrial ecology, the Eco-industrial Park Handbook for Asian Developing Countries defines the eco-industrial estate as a “community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues” (Lowe 2001, sec. 1.2). Hence, the eco-industrial estate differs from the typical industrial estate because it not only offers the possibility of sharing common pollution-control services and facilities, but also explicitly aims at promoting the exchange of goods, services, material, energy, water, waste, and by-products. Owners and operators of an eco-industrial estate explicitly seek enhanced economic and environmental performance through the proactive management of environmental issues. A key benefit of this approach is energy recovery as well as waste recycling and minimization (Schlarb 2001).

However, it has been noted that an effective waste-exchange “market” may be constrained by unreliability in the quantity and quality of waste supplied. Furthermore, the presence of a waste-exchange market may reduce incentives for waste prevention. Finally, implementation of industrial ecology principles into eco-industrial estates requires the careful selection of specific industrial firms. These organizations must be picked from specific sectors of industrial activities that can indeed create this industrial symbiosis among the locators. The effective planning and management of eco-industrial estates is therefore a demanding process. This may explain why, with a few exceptions, eco-industrial estates remain a small proportion of the sector.
Prerequisite Factors

Industrial estates may facilitate the development of a more competitive and cleaner industrial sector, especially in circumstances where there is effective integration of environmental and industrial development policies. The promotion of industrial estates (and eco-industrial estates) is an important component in the set of policy tools that public authorities have available to achieve given targets of pollution abatement and improved ambient environmental quality. However, for industrial estates to achieve their potential as effective instruments for environmental management, a number of conditions must be met.

**Location.** If the primary purpose of industrial estates is to enable industrial development, then these estates must be located to maximize access to markets (inputs and outputs). Additionally, it must be recognized that large quantities of wastewater, air emissions, and solid waste will be produced from this concentration of a large number of industrial facilities. Therefore, to avoid becoming a pollution hotspot, an industrial estate must have space to accommodate proper treatment facilities and have adequate disposal. The geographical location of industrial estates should be part of an overall land-use development plan and should be accompanied by appropriate land-zoning regulations and a cumulative impact assessment of the development area.

**Selection of industries.** The effectiveness of the environmental services provided by industrial estates depends significantly on the industries. More precisely, the compatibility of a facility’s waste with the environmental services and waste treatment provided by the industrial estate is of the utmost importance. Industrial estates should carefully plan the nature of environmental services to be provided by the estates and carefully select the industrial facilities by waste characteristics. There must be clear and strict regulations limiting entry to the estate.

**Environmental management systems.** It is good practice for industrial estates to develop credible and practical environmental management systems (EMS) for the whole of the estate. The EMS should clearly define explicit environmental policies and rules for the estate, environmental performance objectives and targets, mechanisms by which these objectives and targets will be implemented, and a monitoring and enforcement regime aimed at achieving compliance with the objectives and targets.

**Strong environmental regulator.** The promotion of industrial estates does not alleviate the need for a strong environmental regulator, adequately resourced with budget, staffing, and legal authorities, to undertake all that is necessary to avoid industrial estates from turning into pollution hotspots.

**Synergy between industrial and environmental policies.** Practice shows that in many developing countries, pro-growth industrial policies that promote
the development of industrial estates occasionally take a step further by shifting the oversight of the estate’s environmental operation to an agency that lacks the capacity to effectively oversee the industrial estate’s environmental management and performance. Shifting most or all monitoring and enforcement mandates onto such ill-equipped agencies, or occasionally onto industrial estate managers themselves, is generally not conducive to improved pollution control. Unless environmental management objectives are effectively mainstreamed, and integrated into industrial development policies, the effectiveness of industrial estates as an environmental management tool could be limited.

**Advantages and Limitations**

From an environmental management perspective and under certain conditions, such concentration of industrial activity in a single location can offer important benefits for both the industrial facilities located within the estate and environmental regulators.

**Advantages for industrial facilities.** For industrial facilities, the industrial estate is in a position to offer infrastructure and services for which there are significant economies of scale. One example is the use of a common wastewater treatment facility, which would allow for economies of scale to be gained from the collection, treatment, and disposal of solid and toxic waste. Use of such a shared facility would also allow for the provision of effluent monitoring and laboratory services. Industrial facilities may benefit from reduced monitoring and pollution-control costs by sharing a common set of environmental services. Owners and operators of industrial estates recover the costs of providing these environmental services either through their rental rates or by means of user fees set per unit of environmental services consumed (see box 1). It is important to note that user fees may create disincentives for industrial units to use the common

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**Box 1. Thailand Industrial Estates Act B.E. 2522**

Section 37 of the Act gives power to the Minister of Industry to issue ministerial regulation prescribing rules, methods, and conditions for the setting up of industrial estates.

According to the latest ministerial regulation issued under this section in 2005, operators of industrial estates are required to arrange for infrastructure systems, facilities, and necessary services as appropriate for each type of industrial estate, including wastewater treatment facilities. The services and facilities provided must meet standards prescribed by rules issued by the Industrial Estate Authority of Thailand (IEAT).

Section 12 gives IEAT the power to set appropriate fees for the rental of immovable and movable property, maintenance of facilities, and services provided in an industrial estate to generate sufficient funds for the operation of that industrial estate. Section 14 gives IEAT the power to determine the service fees for facilities and services provided in that industrial estate, taking into account the appropriate business rate. The same rule applies where an industrial estate has been developed by a private person or entity.
waste-treatment infrastructure effectively, especially in the absence of strong institutional capacity to monitor the behavior of the firms located within the industrial estate.

**Advantages for environmental regulators.** From the point of view of environmental regulators, industrial estates (including eco-industrial estates) offer three important benefits. First, in circumstances where the explicit purpose of industrial estates is to relocate existing industrial facilities from urban centers and densely populated areas, industrial estates deliver improved ambient environmental quality in the areas from which they are being removed.

Second, industrial estates may be of particular interest to small and medium enterprises (SMEs) whose size often inhibits their use of effective pollution-control technologies. With the regrouping of SMEs into industrial estates and by providing common environmental services, environmental regulators may achieve significant pollution control for this particular category of enterprises, which would otherwise remain a difficult and elusive task. It is important to recognize that SMEs may resist such relocation if the alternative to relocation continues to be no pollution control with impunity. The lack of a strong enforcement regime to overcome such resistance may imply that such relocation be generously subsidized and that pollution-control costs within the industrial estate be scaled from the larger to the smaller facilities.

Third, environmental regulators need not be concerned with the pollution discharge of each individual plant located within the estate, but only with the discharges from the common facility, thereby considerably decreasing the time and resources required to monitor and inspect the pollution discharged from a large number of facilities. Similarly, the enforcement of environmental laws and regulations targets only the provider of environmental services as opposed to a large number of single industrial facilities dispersed over a large area. This is a significant benefit for the environmental regulator, given that resources devoted to the monitoring and enforcement of environmental regulations have generally been recognized as insufficient relative to the task’s complexity and magnitude.

**Limitations.** Industrial estates may thus offer important benefits for both the regulated community of industrial facilities and for environmental regulators. However, despite these apparent benefits, industrial estates are typically not presented as shining examples of proper environmental management. Two notable caveats will be discussed. First, not all pollution-control services offer the possibility of large economies of scale. Such is the case, for example, for the control of air pollution. Hence, the nature and extent of the benefits associated with reduced pollution control will vary greatly and depend on the specific nature of the pollutants of concern.
Second, the concentration of a large number of industrial facilities in a specific and narrowly defined area may be a source of significant environmental damage, and may increase environmental health and safety risks if pollution discharges from the industrial estate are not strictly controlled. Hence, the environmental benefits that may result from industrial estates will not be realized unless there is a strong environmental management system for the estate and a willingness to implement the estate’s environmental rules. Owners and operators of industrial estates are first and foremost industrial promoters working within the context of an industrial development strategy. Incentives are always oriented towards maximizing the value of industrial output. As a result, these environmental benefits will not be realized without sufficient capacity on the part of the environmental regulator to monitor pollution discharges along with the willingness to enforce environmental regulations. As an example, industrial estates competing with one another to attract new locators may have incentives to reduce environmental services fees thus jeopardizing the financing and delivery of effective pollution-control technologies. If this were to be of significant concern, it may be of interest for environmental regulators to establish minimum environmental service fees that all estates must implement.

Interaction with Other Tools and Possible Substitutes

Effective industrial estates require adequate planning, effective management, and a strong regulatory monitoring and enforcement regime. This may especially be the case where the establishment of industrial estates responds essentially to profit motives of land developers, thus leaving environmental management to an afterthought. Proper development of industrial estates should include strategic environmental assessments, environmental impact statements, life cycle cost analysis, land use planning, and risk management tools. See World Bank Guidance Notes on these tools for more information.

Practical Examples of Industrial Estates and Lessons Learned

**Vietnam.** Vietnam’s Ministry of Planning and Investment has a strategic plan to develop industrial estates, with a vision to the year 2020. Their plan is to achieve an annual average growth rate exceeding 20%. The ministry expects that companies sited in industrial estates will experience a 17.7% increase in output in the near term. Furthermore, such companies are expected to increase their share of Vietnam’s industrial exports from 19% to 35% in the near term (Dore and others 2008, 12).
Denmark. The most often cited example of implementation of the concepts of industrial ecology principles is the Kalundborg estate in Denmark. The key component of the estate is a 1500 MW coal-fired power plant that exchanges waste products with other industrial facilities of the estate (for example, fly ash to a cement factory; steam to a pharmaceutical plant, recovered heat to fish farming, and sludge to a fertilizer facility). However, evidence indicates that this system of exchange gradually emerged from a sequence of independent actions as opposed to having been carefully designed, planned, and implemented (Ehrenfeld and Gertler 1997).

Other examples of eco-industrial estates are the Dalian Industrial Estate (China), and the Naroda Industrial Estate (Gujarat, India). Asolekar and Gopichandran (2005) presents further examples as well as case studies.

References and Resources on Industrial Estates


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