Executive Summary

EIPs demonstrate sustainable community economic development by bringing together ideas such as IE; P2; sustainable design, architecture and construction; and company partnering.

The eco-industrial park (EIP) concept has emerged from attempts to apply ecological principles to industrial activities and community design. By marrying industrial ecology (IE) principles with principles of pollution prevention (P2) and sustainable design, architecture, and construction, and by encouraging cooperation among companies to achieve these principles, the EIP demonstrates sustainable community economic development.

This fieldbook provides a guide to the EIP design process. For each of the main partners in EIP development, we aim to

- ➤ identify the issues/problems that one might encounter while designing/building an EIP;
- ➤ discuss the possible solutions to these problems, and how these solutions might differ depending on the specific circumstances;
- ➤ provide some examples of solutions that have worked for others facing similar circumstances; and
- ➤ provide sources of information and other resources for solving these problems/meeting these challenges.

E.1 INTRODUCTION

Many industrial and commercial developers have already applied the principles of IE; P2; and sustainable design, architecture, and construction to existing projects in a piecemeal fashion. However, the real innovation in creating EIPs is bringing such ideas together in an integrated system. During each phase of EIP development (siting, planning and design, construction, and operation), the designer considers how to apply each of these tested strategies. Although not

all of these design options will be feasible for every EIP project, many of them will provide economic and environmental benefits beyond what can be accomplished with traditional industrial development. The challenge is to identify the options that will be feasible under any given set of circumstances.

E.1.1 Background

Because the concept of an EIP is new, no universally accepted definition exists, and the term EIP may refer to many types of development projects. We provide an explicit definition of an EIP, discuss the design elements that contribute to an EIP and differentiate it from traditional industrial developments, and provide an overview of the theoretical foundations of the EIP concept.

An EIP is a Community of Companies

An EIP is a community of manufacturing and service businesses seeking enhanced environmental and economic performance through collaboration in managing environmental and resource issues. By working together, the community of businesses seeks a collective benefit that is greater than the sum of the individual benefits each company would realize if it optimized its individual performance only.

An EIP Integrates Elements of Sustainable Design

Elements of EIP Design

- integration into natural systems
- energy systems
- materials flows
- water flows
- park management and support services
- sustainable design and construction

The difference between an EIP and a traditional industrial development is that an EIP applies multiple strategies for sustainable design. Many of these concepts and practices (see box) have been proven alone but have rarely been put together in this way.

Emerging Conceptual Frameworks Guide EIP Design

Several emerging frameworks inform the process of designing EIPs. The core concept behind the EIP is IE. However, EIPs also apply the principles of design for the environment; P2; and sustainable architecture, construction, and planning. EIPs also challenge companies to form partnerships that increase their competitive advantage.

E.1.2 Objectives

This fieldbook is part of a research project designed to expand the body of knowledge about the viability of EIPs and to provide guidance for EIP design. The project addresses four primary research questions:

R1: How do we determine the potential economic and environmental benefits that may be realized by applying the concepts of IE to current and planned U.S. and Mexican commercial and industrial developments, and what might these benefits be for a prototype EIP in Brownsville/Matamoros?

R2: What is the range of government's appropriate role (federal, state, and local) in facilitating the development and management of EIPs, and how might this role vary in alternative EIP venues?

R3: How do we identify the environmental technologies needed to fully apply IE principles and concepts, and which specific technologies will be needed for the prototype EIP in Brownsville/Matamoros?

R4: How applicable are the results of the Brownsville/ Matamoros case study to other venues, particularly other border area industrial parks?

The project team took two approaches to addressing these questions. The first approach was to develop a case study of a prototype EIP for Brownsville, TX/Matamoros, Mexico. The second was to develop a fieldbook that addresses the challenges identified by the case study (see box on next page) and to serve as a guide for EIP development.

E.2 DEVELOPING AN EIP: CHALLENGES TO COMMUNITIES

Public-sector groups may play a major role in developing EIPs. The motivation for public participation is the potential economic and environmental benefits of an EIP. At the same time, EIP development poses unique challenges to the public sector. These additional benefits and challenges argue for an expanded role for communities, which have at their disposal many of the tools required to meet the challenges to EIP development.

Challenges to EIP Development

Developing an EIP involves combining strategies that, taken alone, are previously tested and proven but have rarely been combined in a single project. As with any untested concept, particularly one that requires this level of interdisciplinary integration, there are bound to be risks, and challenges.

Challenges to Communities

- Building local support for the EIP
- Setting EIP performance objectives
- Determining the appropriate EIP ownership strategy
- Developing EIP financing strategies
- Reducing administrative red tape

Challenges to Potential EIP Members

- Estimating EIP benefits and costs
- Determining the right mix of EIP partners
- Finding appropriate technologies
- Reducing regulatory uncertainty and liability

Challenges to the Regulatory Community

- Streamlining zoning, permitting, and other development regulations
- Adding flexibility to environmental regulations
- Developing appropriate technology, promoting technology transfer, and providing technical training
- Encouraging the exchange of information among EIPs

Challenges to Developers, Designers, and Builders

- Choosing a site that will maximize EIP benefits
- Designing EIP infrastructure that incorporates the needs of the EIP members for specialized services
- Designing industrial facilities that provide the flexibility that allows the EIP to grow and evolve
- Designing buildings that maximize the efficiency of energy and materials
- Using construction practices that are consistent with the EIP vision

Challenges to EIP Managers

- Managing the design and development process
- Recruiting companies for the EIP
- Maintaining relationships between companies

E.2.1 Introduction

Public-Sector Roles in EIP Development:

- ➤ Building local support
- ➤ Setting EIP performance objectives
- ➤ Sharing ownership, development, and costs
- ➤ Developing EIP financing strategies
- ➤ Reducing administrative red tape

Developers of EIPs face challenges at every phase of the EIP development project, from siting to operation. Given these challenges, and the significant amount of energy and resources that may be invested in such a project, a community must determine which of the EIP design options is viable, and whether the considerable challenges to EIP success can be overcome. Two points about EIP challenges are worth noting:

- ➤ **A community can design an EIP that meets the goals of many stakeholders**. An EIP can incorporate a variety of strategies, and the level of integration of these strategies may depend on which options gain support in the community.
- ➤ **Evidence of potential EIP benefits will build community support**. A preliminary step in EIP design is to assess the potential benefits to the community of alternative EIP designs. If these benefits are potentially substantial, the required individuals will be willing to support EIP design ideas with their time, energy, and resources.

E.2.2 Building Local Support for the EIP

One of the challenges to communities building EIPs is overcoming fragmentation among stakeholders to build a coherent, cooperative team.

EIP stakeholders include

- ➤ leaders in the industrial and financial community;
- ➤ representatives of local companies and potential future tenants in the EIP;
- ➤ the local Chamber of Commerce;
- ➤ public-sector stakeholders from city government, as well as county, state, and federal agencies;
- ➤ labor representatives;
- ➤ community and environmental organizations (including leading opponents of development);
- ➤ educational institutions; and
- ➤ practitioners with the full complement of capabilities needed in the project: architecture, engineering, ecology, environmental management, and education and training.

Successful EIP design, construction, and management require that these groups agree on a vision for the EIP and work together to

achieve it. The following points are particularly important to building community support:

- **An assessment of the available resources will help to direct efforts for gaining support.** These resources may include individuals, organizations, sources of information/data, and anything else that can support the project.
- **An EIP requires a local champion.** Successfully developing an EIP requires an individual champion who is committed to the principles of IE and capable of selling these concepts to all stakeholders. The champion must be credible to individuals or organizations capable of taking a financial interest in the success of the park.
- **An EIP also requires a core project team.** The core team is responsible for assembling an economically viable development plan for an industrial park that is well integrated into the community as well as the local and regional ecosystems.
- **Stakeholders must understand the local context and potential benefits of an EIP.** Because few people truly understand the concept of an EIP, educating the community and enlisting a broad range of stakeholders are important early steps.
- **EIP support can be strengthened by integration with a larger community planning process.** Some stakeholders may be more likely to support the EIP if it becomes part of a larger community planning process.
- **Commitment can be demonstrated to stakeholder interests by setting performance objectives.** Stakeholders are more likely to support the EIP if they have evidence that their interests will be protected.

E.2.3 Setting Performance Objectives for an EIP

The site chosen for the EIP; the recruiting strategy; the design of infrastructure facilities, buildings, and common areas; the construction methods used; and EIP management methods all depend on the EIP's performance objectives.

The purpose of setting performance objectives for the EIP is to guide its design and operation. The site chosen for the EIP; the recruiting strategy; the design of infrastructure facilities, buildings, and common areas; the construction methods used; and EIP management methods all depend on the EIP's performance objectives.

The EIP team can use established practices for setting performance objectives in the economic, technical, and social domains. However, because the EIP will usually have objectives that surpass environmental compliance, a nontraditional objective-setting process may be required to determine environmental performance objectives

An EIP May Require Community-Level Economic Performance Objectives

When the EIP requires public investment, community-level performance objectives, such as community economic growth, employment growth, costs of local services, tax revenues, and the cost of environmental clean-up, may be considered. Performance objectives for EIP management and owners might address revenue, property values, and tenant turnover. Performance objectives for an EIP company might include profits, return on investment, and payback period. Costs and revenues for specific EIP-related activities might also be tracked.

Environmental Performance Objectives Provide EIP Design Guidance

Environmental performance objectives provide an essential framework for designing an EIP. They express the EIP project vision as a set of expectations for how it will actually function. The objectives establish a context for later defining more explicit, measurable goals. The objectives document will be a continually evolving guidance system for the EIP project.

E.2.4 Determining Ownership

An EIP can be owned by a public-sector agency, such as a development authority, port authority, or university, or by the private sector. The issues in deciding between public or private ownership of an EIP include the following:

- availability of public land sufficient for the development,
- availability of industrial bonding capability and public support to pass bonds (if land must be acquired for public development),
- access to developers willing to take a position in innovative projects (given that the basic need for an EIP can be demonstrated), and
- ability of the economic development agency to take major responsibility for the EIP development process (as opposed to a supporting role).

Although current EIP projects are primarily publicly owned, privately owned EIPs are possible, especially after current EIP demonstration projects have matured to demonstrate whether EIPs can be profitable for private developers. Several important points are germane to the EIP ownership issue:

Whether developed under public or private ownership, an EIP inevitably needs strong public/private partnership to make it a success.

- **Although public ownership has some advantages, private ownership may be feasible.** A public agency or authority brings several advantages to an EIP development project, including possible financing, property, and direct incentives to companies. On the other hand, private ownership might be better if private developers are willing to take the lead in an EIP project or if public agencies do not have the capability for industrial park development.
- **A university can be an EIP owner or developer.** Universities have established research parks used as sites for labs; new ventures commercializing campus research; and, in some cases, a broader mix of industrial and service companies.
- **Regardless of who owns the park, public/private cooperation is essential.** Industrial parks always require close coordination between public and private sectors, no matter who actually owns the development. An EIP is likely to require even closer partnership to capture the full benefits for the community.

E.2.5 EIP Financing Strategies

Financing any industrial park requires money for

- initial project planning leading to a site-design concept;
- at least two stages of environmental, architecture, and engineering studies leading to a feasibility analysis;
- acquisition of the land;
- site development;
- construction costs; and
- project operating costs.

Strategies for Reducing EIP Investment Risk

- Investment of public land
- Municipal bond financing
- Commitment by an anchor tenant
- Commitments by local utilities
- Partial site development
- Limiting the number of new ventures
- Support to start-up companies
- A liability-free site

Some of these costs will be higher for an EIP than for a traditional office park (e.g., the integrated ecological design process in project pre-planning and planning).

A community developing an EIP financing strategy should consider the following:

- **An EIP requires an effective marketing plan.** Team members should consider marketing the EIP project to investors by linking it to established development categories rather than emphasizing its innovative aspects.
- **Risk reduction strategies are important to securing some types of financing.** An EIP's public/private partnership provides opportunities for reducing the risk of investment.
- **A number of sources are available for EIP financing.** These sources include

- ✓ municipal bond financing,
- ✓ tax increment financing for brownfield redevelopment,
- ✓ investment of publicly owned land,
- ✓ state economic development funds,
- ✓ local commercial banks,
- ✓ insurance company or pension fund environmental venture investment funds, and
- ✓ incentives.

E.2.6 Easing the Public Approval and Regulatory Processes

The process by which communities decide the location, type, and timing of industrial park development is highly political. Supporters of EIPs will face all of the public approval and regulatory hurdles that traditional developments face, unless the community is motivated to reduce these burdens by streamlining codes, enforcement, permitting, and zoning.

E.3 PARTICIPATING IN AN EIP: CHALLENGES TO POTENTIAL EIP MEMBERS

Potential EIP members face several challenges in maximizing the benefits and minimizing the costs and risks of EIP membership.

E.3.1 Estimating EIP Benefits and Costs

Companies face several challenges in maximizing the benefits of EIP membership:

- ➤ Estimating EIP benefits and costs
- ➤ Determining the right mix of partners
- ➤ Finding appropriate technologies
- ➤ Reducing regulatory uncertainty and liability

A company considering EIP membership needs to consider the economic costs, benefits, and risks of alternative EIP design options. Below, we describe some methods for examining the costs and benefits of some EIP design options.

- ➤ **Perform a preliminary economic analysis of the potential for a byproduct exchange.** Several analyses can provide a preliminary indication of the potential for economic benefits of participating in an EIP byproduct exchange. These analyses include performing a waste minimization assessment and assessing sources of raw materials.
- ➤ **Consider the benefits of outsourcing in-house activities that are not part of the company's core competency.** The potential tenant must examine whether services such as purchasing, building services, training, marketing and sales, and environmental management can be outsourced to the EIP without adversely affecting the company's primary business.

- **Determine the potential for using membership in the EIP as a marketing strategy.** If customers are sensitive to the environmental impact of their suppliers, an EIP membership may increase sales revenues; reduce the cost of capital; or attract talented management, engineers, and other specialized employees.
- **Examine the potential to reduce regulatory costs by becoming a member of an EIP.** EIP membership may reduce the costs of environmental compliance and the proper treatment and disposal of wastes.
- **Perform a formal economic analysis of alternative design options.** If preliminary analyses of potential EIP opportunities seem promising, potential EIP tenants should perform a formal economic analysis of the EIP design options.

E.3.2 Determining the Right Mix of EIP Partners

Participating in an EIP is one way of taking advantage of partnering, or networking, as a source of competitive advantage. The challenge to EIP tenants is to maximize partnership opportunities while minimizing risks. Some risks and strategies for minimizing them include the following:

An EIP member can minimize the risk of losing a critical supply by writing appropriate supply contracts and maintaining standby capability with alternative suppliers.

- **Loss of a critical supply or market.** If an EIP partner closes down or changes its product mix, its suppliers and customers may risk losing a key supply or market. To some extent, this risk can be managed in the same way as other supplier relationships: writing contracts that stipulate supply reliability and include recourse if obligations are not met, and maintaining standby capability with alternative suppliers.
- **Misuse of proprietary information by competitors.** Adequate security systems on the network should reduce this risk. However, EIP members must negotiate contracts that protect sensitive process information and build trust among partners.
- **Uneven quality of byproduct materials could cause damage to equipment or poor products.** The handling of this issue is a fairly standard contracting procedure for any supplier relationship. Both EIP management and tenant companies would need strong quality control standards and processes.
- **Reduced flexibility for waste reduction and substitution of toxic materials.** The P2 solutions of materials substitution or process redesign should take priority over trading toxics within an EIP site. The commitment of the companies to the EIP's performance objectives will keep this basic P2 principle active.

E.3.3 Finding the Right Technologies and Reducing Technological Uncertainty

Identifying opportunities to maximize relationships with other EIP members may take some creativity. Often, the waste of one company and the input required by another are not a perfect match. EIP managers and members might have to research technologies or methods that enable the relationship to be productive (e.g., improving the quality or consistency of a byproduct or altering a production design to accommodate an alternative input).

E.3.4 Reducing Regulatory Uncertainty and Liability

The regulatory status of EIPs is somewhat uncertain. EIP members would be wise to take some steps to reduce the regulatory risk of EIP membership. The EIP developer and its tenants will have to be sure that there is early agreement among local, state, and federal regulators regarding the regulatory status of the EIP. EIP managers can also play a role in reducing the liability risk to EIP members through regulatory auditing, monitoring, training, and technical assistance.

E.4 ENCOURAGING EIPS: THE ROLE OF GOVERNMENT

The appropriate role of government at each level depends, in part, on how widely the benefits are shared.

Government has a role to play in EIP development because EIPs can potentially provide benefits beyond the private benefits to their participants. However, the appropriate role of government at each level depends, in part, on how widely the benefits are shared:

- Local government's efforts are most appropriately focused on specific EIP developments in their communities.
- State governments may play a wider role, enabling the development of EIPs across a state through state regulatory innovations, tax policies, and the statewide technology transfer offices.
- The federal government can play an even wider role, encouraging EIPs through revision of federal legislation, development and transfer of technologies broadly supportive of EIPs, and support of information sharing among EIPs in different parts of the country.

Government also places a number of constraints on what a company can do. Most of these constraints have a clear purpose—to protect some public interest that would not normally be considered by the company. The challenge to all levels of

government is to balance the public's interest in controlling the activities of industry with industry's need for flexibility in implementing the EIP strategy. Specific challenges to the regulatory community include

- ➤ streamlining zoning, permitting, and other development regulations;
- ➤ adding flexibility to environmental regulations;
- ➤ developing appropriate technology, promoting technology transfer, and providing technical training; and
- ➤ encouraging the exchange of information among EIPs.

E.4.1 State and Local Governments' Role in Successful EIPs

State and local governments can play several important roles in the success of an EIP. State and local government can

- ➤ take the lead in the EIP development process;
- ➤ include the EIP as part of state and local economic development strategy;
- ➤ streamline zoning, permitting, and other laws related to industrial park development;
- ➤ participate in EIP financing;
- ➤ provide technical assistance, technology transfer, and training;
- ➤ remain flexible in their implementation of federal environmental regulations; and
- ➤ provide other incentives—such as tax breaks, industrial development bonds, and publicized award programs—and export support programs.

E.4.2 Federal Government Roles in EIP Development

Like state government, the federal government can play a number of roles in the development of EIPs. The federal government can support EIPs by

- ➤ enacting regulatory changes that allow EIPs to take advantage of their opportunities for reducing environmental burden while improving their economic performance;
- ➤ funding EIP planning and development;
- ➤ funding R&D and technology transfer for environmental technologies;
- ➤ promoting voluntary initiatives for EIP participants; and
- ➤ facilitating the transfer of information among EIPs.

E.5 DESIGNING AND BUILDING EIPS: CHALLENGES TO DEVELOPERS, DESIGNERS, AND BUILDERS

The challenge to an EIP designer is to incorporate as many EIP design options as is economically feasible. This includes

- ➤ choosing a site that will maximize the economic and environmental benefits of an EIP,
- ➤ designing park infrastructure that incorporates the needs of the EIP members for specialized services,
- ➤ designing industrial facilities that provide the flexibility that allows the EIP to grow and evolve,
- ➤ designing buildings that maximize the efficiency of energy and materials, and
- ➤ using construction practices that are consistent with the EIP vision.

E.5.1 Selecting, Assessing, and Planning a Site

Because EIPs aim to maximize environmental and economic performance, special care should be taken when selecting and planning a site.

An EIP planner must choose among three possible types of EIP sites:

- ➤ virgin land (greenfield sites)
- ➤ currently operating industrial parks
- ➤ contaminated (brownfields) sites

Brownfield sites are abandoned, idled, or under-used industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.

In choosing among these, an EIP planner must consider the following:

- ➤ A greenfield industrial park offers the highest degree of freedom for applying and testing new approaches. Points of control in the design process are relatively well defined and commonly understood, and these opportunities may engender a high level of innovation in participants.
- ➤ The conversion of currently operating industrial parks to EIPs requires working with established parks and their companies to fundamentally enhance environmental performance and, where necessary, clean up past pollution.
- ➤ Brownfield sites pose difficult challenges but some advantages. In the past, developers have avoided brownfield developments because of the financial risks they pose. However, these sites may offer some advantages, such as their location; their amenities; and the environmental, social, and economic benefits of redevelopment. Changes in regulations regarding the redevelopment of brownfields

and the limits of owner liability are meeting some of these challenges.

E.5.2 Challenges in the Design of Physical Infrastructure

EIP infrastructure design differs from that of traditional industrial parks because designers aim to integrate options that minimize the environmental impact of infrastructure and the operations they support while meeting technical, financial, and logistical requirements.

An industrial park infrastructure encompasses the physical support systems used by most, if not all, of the tenants of the park (and their employees and support services). EIP infrastructure design differs from that of traditional industrial parks because designers aim to integrate options that minimize the environmental impact of infrastructure and the operations they support while meeting technical, financial, and logistical requirements. EIP infrastructure designers must also build flexibility into their designs to ensure that the infrastructure will not become obsolete as the EIP evolves.

Important elements of EIP infrastructure include the following:

- **Transportation.** Transportation infrastructure must support the transportation of materials, products, and people.
- **Energy.** To meet EIP performance objectives, energy infrastructure should optimize energy use through cascading and cogeneration and should maximize the use of renewable sources.
- **Water.** To reduce the use of water, an EIP's design should include water infrastructure that can reduce the demand for external supplies by efficient use and reuse.
- **Materials byproducts and solid waste.** An EIP might include infrastructure to support the exchange of materials and to handle some byproducts marketed off-site.
- **Telecommunications.** The EIP's telecommunications infrastructure, including a sitewide information system, can contribute to the success of its tenants, especially small to mid-size companies, and to the operation of the park itself.
- **The commons.** Because an EIP is a community of companies, physical space that enables employees to interact is important. Common areas can also allow companies to share facilities that would not be fully used by a single company.

E.5.3 Challenges of Integrated Facility Design

Companies building new plants in an EIP have an opportunity to apply sustainable architecture, P2, energy efficiency, and IE in the design of their production processes. Some options for supporting more integrated facility design include the following:

- Create a database of designers and consultants capable of supporting tenants in this approach.

- ➤ Include consultants in socio-technical systems (STS) methods of designing facilities and work systems for high performance.[1]
- ➤ Offer workshops on integrated facility design for tenants' design teams (possibly through local engineering and architecture schools).
- ➤ Link companies' design teams through an online bulletin board for sharing ideas (chiefly, on their design processes, not results).

Although many innovations in sustainable design are relevant to industrial facilities, certain considerations place limits on their application. For instance, the performance requirements for a power plant or chemical process plant, at any scale, make it difficult to base materials selections on a recycled content criterion. The first-order needs are safety, durability, and successful operation and maintenance.

E.5.4 Challenges in EIP Building Design

An EIP has environmental objectives that require innovations in building design.

Life Cycle Building Design

For designers the long-term challenge is to consider each stage of a building's life-cycle and to seek an overall plan that balances economic and environmental needs through all of these stages. Life-cycle building design incorporates the following environmental factors:

- ➤ **Constructability**: Rather than considering only schedule and budget, an EIP design team should also consider the impact of design choices on the environmental impact of the construction process.
- ➤ **Durability**: The objective of conserving environmental and economic resources suggests design for durability.
- ➤ **Flexibility**: Building designers can extend the life of the building if it is easy to redesign, expand, and retrofit as uses and technologies change over time.
- ➤ **Maintainability**: Designers can offer building managers major cost savings by designing to minimize maintenance effort and to enhance the ease of maintenance.

[1]Companies using this approach include Volkswagen Canada, Hoescht Celanese, and Exxon Canada. See Appendix H for a brief overview.

- **Livability**: Designers are giving increasing attention to people's comfort in the design of manufacturing, service, and office space.
- **Deconstruction**: Design for deconstruction seeks to capture the highest value from the energy and materials invested in this structure at the end of a building's life-cycle.

Energy Efficiency

The costs of operating a building's energy systems over a lifetime may easily surpass its construction costs. This realization has led designers to seek new (and sometimes old) methods for operating buildings with a much higher level of energy efficiency.

Materials

Sustainable designers are considering several environmental factors in their choice of materials: embodied energy content and other life-cycle impacts of the material, the source, the recyclability of the material, and toxic content. These factors complement traditional criteria of durability, strength, and appearance.

Water

Designers can gain significant savings in water use through equipment choices. Options include low-flow shower heads, faucets, and toilets and electronic sensors or foot pedals to control faucets. Efficient design of open-cooling tower systems should reduce water use and minimize pollution from chemicals used.

Water recycling and reuse options can include the following:

- Dual systems of pipes can separate human wastes from graywater.
- Depending on reuse opportunities, the EIP may need a system to accommodate several grades of water, with equipment or natural means for filtering and processing. Deep soil beds may be sufficient for most graywater.
- Passive recovery systems or heat pumps can recapture heat in industrial process water.
- Tanks or ponds for capture of stormwater from roofs may be useful in dry regions.

Overall, designers will need to design building water systems in terms of actual or potential interchange with other plants at the EIP.

E.5.5 Construction Process

The construction process is an opportunity for the EIP team to implement EIP principles and work toward meeting environmental performance standards by minimizing the impact of construction practices on-site, minimizing energy demand, and reusing and recycling construction materials. Challenges to implementing these principles include

- integrating construction management,
- minimizing the impact of construction processes on the site,
- minimizing the energy demand of construction, and
- reusing and recycling construction materials.

E.6 CHALLENGES TO EIP MANAGERS

Managing an EIP is different from managing a traditional industrial park. The design and development process and EIP recruitment pose challenges specific to an EIP. An EIP manager must respond to the needs of two distinct but overlapping business interests: a real estate development property that must be managed to provide a competitive return to its owners, and the "community of companies" that must manage itself to gain common benefits for its individual members.

E.6.1 Managing the Design and Development Process

An EIP developer is challenged to manage the design and development process and to recruit companies to the EIP. Managers of an operational EIP face three challenges: maintaining the community of companies; managing the EIP property, administration, and support functions; and ensuring the future viability of the EIP.

The design and development process for an EIP is more complex and challenging than that of a traditional industrial park. In any industrial park project the development agency or private developer must manage relationships with community and environmental organizations; designers; prospective tenants; and zoning, planning, and regulatory agencies. The added challenge in an EIP is seeking environmental performance beyond compliance while maintaining the financial viability of the project and its attraction to tenants. Coordinating the mix of organizations, personalities, and interests in achieving these twin objectives is a major management challenge.

Special challenges to design and development of an EIP project include the following:

- securing finance for the planning stage of the EIP,
- developing EIP covenants,
- accessing professional services,

- ➤ managing project communications,
- ➤ keeping up to date about changing regulations and other constraints on the EIP development, and
- ➤ integrating across different systems of planning.

E.6.2 Recruiting Companies for EIPs

Recruiting companies for EIPs poses unique challenges because it requires achieving balance between

- ➤ traditional marketing strategies and an EIP's unique advantages,
- ➤ economic and environmental goals,
- ➤ filling the park and getting the "right" mix of companies for byproduct exchanges (the industrial ecosystem), and
- ➤ outside recruitment and local business development.

When developing a recruitment plan, EIP planners should consider the following:

- ➤ **Companies seeking new plant locations will consider the possible advantages of an EIP along with a host of traditional criteria**. These criteria include the local supply of labor, materials, energy, and capital; the proximity of markets; the local business climate; and livability of the area.
- ➤ **An EIP recruitment plan can combine traditional marketing strategies and an EIP's unique advantages**. These advantages include improved economic and environmental performance through eco-efficiency and synergistic relations among the park's companies.
- ➤ **Economic and environmental goals should be balanced in EIP recruitment.** The economic and environmental goals of the EIP will guide its design and influence the industrial makeup of the park.
- ➤ **Recruiting for a byproduct exchange network should be balanced with filling the park.** The goal of developing and maintaining a resource exchange should not endanger the financial goal of minimizing EIP turnover and vacancy. The risks of the byproduct exchange can be limited by targeting a reasonable level of resource exchange, testing the strategy at different phases of EIP development, and limiting the goal of resource exchange if it delays the recruitment process.
- ➤ **Planners must create the conditions necessary for a successful EIP exchange network.** Recruitment for the byproduct exchange can be facilitated with a feasibility study. Planners should provide the necessary information and tools to allow companies to determine the potential benefits of participating and to minimize their risks.

- **Attraction of the EIP must be balanced with growing new firms.** The most effective strategy for filling an EIP may be to balance attracting existing businesses with supporting the formation of new companies. Many facets of EIP operation open specific opportunities for developing new businesses, such as decomposer firms, remanufacturing plants, environmental monitoring and information firms, transportation services, and environmental management services.

E.6.3 EIP Management Structure

The two management interests in an EIP are
- management of the EIP property and
- management of the community of companies.

The EIP has two separate operations to manage: the EIP property and the community of companies. Managers of the EIP property will be accountable for the business performance of the developed property. Managers of the community of companies will share the property managers' concerns, but their primary concern is maintaining their cohesiveness without compromising their autonomy.

The EIP requires two different types of management entities to serve its two different management interests:

- the property management company (PMC), which has primary responsibility for maintaining the property, recruiting firms, negotiating leases, managing lease revenues, interacting with the public, maintaining infrastructure, and providing support services, and
- the community self-management system (CSMS), which is a tenants' association (an owners' association or trust if the companies have purchased their sites) that handles functions for which the companies share joint responsibility.

E.6.4 Building and Maintaining the Community of Companies

Building and maintaining the community of companies requires sensitivity to companies' concerns about interdependence. The EIP manager can encourage collaboration by creating a context in which companies can learn first hand the benefits of self-organization and cooperation. Maintaining the community requires a process for resolving conflicts and maintaining the values, culture, and identity of the EIP as a community.

E.6.5 Managing EIP Property, Administration, and Support

The EIP manager is responsible for maintaining EIP property, managing shared infrastructure, supporting byproduct exchanges,

auditing members and enforcing standards, and coordinating the provision of shared support services. Two responsibilities pose special challenges to EIP managers:

- ➤ supporting the byproduct exchange by, for example, recruiting companies, modeling the network, researching technologies, providing linkages with other resource exchange systems, and negotiating with regulatory agencies, and
- ➤ overseeing shared support services, including environmental management and emergency management.

E.6.6 Ensuring the Future Viability of the EIP

Relations with the community are important because the EIP may have been publicly financed, may have been given some special zoning or permitting considerations, or may have benefited from the efforts of community leaders.

Ensuring the future viability of the EIP requires that managers perform a variety of ongoing activities:

- ➤ recruit firms to keep the park fully leased and maintain the mix of companies
- ➤ track present trends and emerging challenges and opportunities
- ➤ support continuous evolution of economic and environmental performance
- ➤ manage relationships with the community

E.7 SUMMARY: EIP SUCCESS FACTORS AND TRANSPORTABILITY

EIP development faces many challenges for each of the participants and stakeholders. Overall, the transportability of the EIP concept depends on the ability to adapt the solutions suggested in this fieldbook to specific local circumstances.

We have identified several conditions that are favorable to meeting the challenges to EIP success:

- ➤ The EIP development process must be a public/private partnership.
- ➤ Potential EIP members must carefully consider which of the EIP design options will maximize their opportunities to benefit from the EIP.
- ➤ In supporting EIPs, government agencies must balance the public interest with industries' needs.
- ➤ EIP designers must incorporate EIP design options that balance economic and environmental performance.
- ➤ An EIP manager must respond to the needs of two distinct business interests.

Disclaimer

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