Applying Eco-Industrial Development

September 2012

Timothy Nolan
Sustainable Industrial Development Coordinator
Resource Management and Assistance Division
tim.nolan@state.mn.us

Minnesota Pollution Control Agency

Industrial Ecology is the Discipline Driving the Practice of Eco-Industrial Development

IE concepts can be applied on different scales.

Within Firm

design for environment
pollution prevention
eco-efficiency
green accounting
green chemistry
clean production

Across Firms

industrial symbiosis
product life-cycles
byproduct synergies
inter-firm closed-loop production
greening supply-chains
sharing facilities

Regional/Global

balanced ecological budgets and cycles
system-wide materials, energy and water flows
interface with ecological systems
resource efficient value-chains

Eco-Industrial Development is about the most efficient industrial facilities and processes that:

- Systemically optimize material, energy, and water flows throughout industrial supply chains.
- Maximize productive use of input resources and by-products, waste is non-productive.
- Minimize impacts on the environment by moving toward zero waste and emissions.
- Integrate sustainable design in facilities and sites.
- Utilize clean production and eco-efficient technologies and processes.
- Maximize use of renewable energy systems and sustainably produced feedstocks.
- Establish the business relationships to share amenities and facilities.

A True Eco-Industrial Development Applies Advanced Environmental Strategies

- Industrial symbiosis and byproduct exchanges
- Eco-industrial parks or clusters
- Renewable-based energy and feed stocks
- Closed loop production and waste recovery systems
- Green manufacturing and eco-efficiency
- Green chemistry and product design for the environment
- Zero waste and emissions
- Greening supply chains
- Eco-enterprises and commercialization of clean technologies
- Sustainable design methods

EID Integrates Ecological Design into Industrial Development

- Requires a proactive approach applied in early stages of industrial development projects.
- Provides a way to integrate industrial ecology concepts and methods to create eco-industrial facilities and parks.
- Conducting EID is complex and linked to larger community development efforts in the region supporting the industrial development.

What is an Eco-Industrial Park?

“A community or network of companies and other organizations, in a physical park, who choose to interact by exchanging and making use of byproducts and energy in a way that provides one or more… benefits over traditional, non-linked operations."

Benefits can include:

- Reduced natural resource inputs
- Reduced pollution - energy use – wastes
- Increases in value of non-product outputs

Extrapolated from Gertler 1995

US Eco-Industrial Development Examples

ENERGY-BASED

Red Hills Ecoplex
Choctow County, MS

Hillman Industrial Park
Hillman, MI

Spiritwood Station,
North Dakota

ENVIRO TECH

Chicago Center for Green Tech
Chicago, IL

MATERIALS RECOVERY

Cabazon Resource Park
Indio, CA

HYBRIDS

Riverside Eco-Park
Burlington, VT

Fort Devens
Devens, MA

ECO-PARKS

Silver Bay,
MN

ReVenture Park
Charlotte, NC

Londonderry Eco-Park
Londonderry, NH

Benefits to Environment

- Less waste, emissions, and pollution.
- More efficient use of energy and resources results in higher levels of clean production.
- Superior performance, goes beyond regulatory thresholds, and can help streamline regulatory processes.
- Replacement of fossil based energy and materials.
- Increased use of renewable energy and sustainable materials.
- Industrial system and supply-chain pollution prevention versus facility-based approach.

Benefits to Business

- Greater resource efficiency equals decreased operating costs.
- Enhanced competitiveness and potential for revenue generation.
- Increased return on capital investments and asset value.
- Energy security and independence.
- Stronger connections with suppliers, customers, and community.
- Access to eco-product markets - capitalizes on the growing consumer demand greener products.
- Reduced future costs to business and community such as clean-up liabilities.

Benefits to Community

- More sustainable industrial operations and local prosperity creation.
- Can strengthen existing business base and enhance recruiting.
- Reduced long-term infrastructure and operations costs.
- Reduced emissions resulting in improved community health.
- Improved community industry relations, quality job creation, and workforce attraction.
- Enhanced community identity through eco-branding.
- Strengthens local economy through regionally produced feed stocks, products, and services.

Eco-Industrial Park
Planning – Design – Development

General Steps to Develop Eco-Industrial Parks

- Organize project and undertake initial planning.
- Conduct baseline analyses.
- Evaluate current environmental conditions and socio-economic impacts.
- Account for present and future costs.
- Determine technology needs and process to validate new technologies.
- Initiate EIP feasibility process.

Begin with Project Organization

- Identify EID goals and principles, establish a vision.
- Determine how EID goals align with community values and strategies.
- Develop EID project scope and general plan.
- Develop oversight team to lead project and establish communication approaches, including community representatives and developers.
- Determine project partners and resources; financial, technical, human.

Baseline Analyses

- Conduct energy profiles; supply systems, local commercial and industrial users, types and amounts.
- Quantify available waste streams including management methods, recycling efforts, industrial by-products.
- Assess existing regulatory and policy framework; national, state, local.
- Inventory site, community and regional assets and existing infrastructure.
- Identify underutilized facilities, land, and equipment.
- Uncover symbiosis opportunities between facilities and operations.

Baseline Analyses Continued

- Assess current industrial activity including material, energy, and water use profiles from local industries.
- Profile current supply-chain relationships.
- Analyze current market conditions.
- Analyze local and regional flows of raw materials, energy, water, goods, and services.
- Infrastructure mapping; facilities, utilities (use GIS models).
- Assess current transportation systems and improvement options.

Determine From Baseline Analyses

- Local conditions and assets; strengths, weaknesses, opportunities, threats.
- Current industrial activity and scenarios for eco-industrial development.
- Infrastructure and capital investment needs.
- How to identify, qualify, and educate on the benefits.
- Leverage points and opportunities to achieve superior performance in operations.
- Barriers and strategies to overcome, short and long-term.

Eco-Industrial Park Feasibility Process

- Conceptualize proposed industrial facilities and specific EIP scenarios.
- Identify and profile actual and prospective anchor and ancillary enterprises.
- Conduct feasibility studies for eco-industrial park or cluster.
- Determine structure of networks for anchor and ancillary enterprises.
- Conduct supply chain analysis including market applications.

Eco-Industrial Park Feasibility Process

- Determine the alternatives for renewable energy generation.
- Create conceptual site designs including type and scale of facilities.
- Identify sustainable design guidelines for site and buildings.
- Determine opportunities for natural and engineered green infrastructure.

EIP Business Development Activities
Anchor Enterprises

Identify champions, existing anchor enterprises and entrepreneurs

- potential core tenant eco-enterprises
- potential local business expansions
- independent entrepreneurs

Begin recruitment dialogue with interested parties

- emphasize eco-industrial advantages
- align local incentives and controls
- apply external incentives available

Integrate external stakeholders into recruitment dialogue

- state agencies and federal agencies
- local commercial banks and investors

Select anchor enterprises and market development program to support recruitment

- develop plan to address infrastructure needs
- review workforce requirements for anchor enterprises
- coordinate raw material supply systems

EIP Business Development Activities
Ancillary Enterprises

Identify existing ancillary enterprises and entrepreneurs

- qualify anchor tenants' interest in ancillary enterprise development
- supply chain vendors
- independent entrepreneurs

Same recruitment process as anchor

- development parameters dependent on anchor businesses

Establish Incentives and Local Controls

Local Incentives

Identify incentives and align with EID program

- Tax incentives
- Resource efficiency
- Umbrella permitting for superior performance
- Access to community-based renewable energy
- Educational eco-efficiency business assistance

Local Controls

Identify local controls for EID

- Changes to building, zoning codes
- Codes and covenants attached to properties
- Changes to community comprehensive plan
- Explore potential for innovation in applicable state and local regulations
- Mandate superior performance guidelines for facilities and industrial processes

Develop Governing By-Laws

The By-Laws build upon the sustainability goals and objectives set forth in community comprehensive plan.

The principles of sustainability are woven into the By-Laws through:

- zoning, density, dimensional requirements
- floodplain, water resource, historic district
- signage and wetland protection provisions

Determine Role and Structure of EIP Administration

Managerial

- enforce covenants, decide on new companies, collect rents and assure taxes and charges are paid, responsible for maintenance and order on the estate

Technical

- responsible for common facilities, training and technical services

Financial

- oversees loans to estate tenants, arrange for cooperative purchasing agreements for materials

EIP Management Tools

Codes & Covenants

- Standard operating procedure for EID in USA

Design Guidelines

- Drive down operating costs & environmental impacts
- Protect businesses' investment in their facility

Environmental Impact Assessment

Continuous Improvement models

EIP Management Tools

Financial Decision-making Tools

- Project financing, Return on Investment, Discounted Cash Flow, Return on Assets/Equity, Full Cost Accounting

Recognize & engage local resources

- Tenant firms & parent companies
- Government agencies
- Universities

Market-based Standards

Develop Guidelines for Eco-park

Assess existing local environmental conditions and issues.

Develop environmental management performance objectives.

Develop plan for environmental management systems and projects.

Implement environmental management projects.

- EIP initiatives
- Bilateral initiatives
- Company initiatives (internal)

Develop Plan for Operations

Base environmental management system on ISO 14001 or similar standards for facility operations.

Form a tenants' association or other coordinative mechanism to oversee the EMS on two different levels:

- The parks' environmental impact
- Cooperative links between individual firms to encourage EMS application

Key Lessons

- Eco-Industrial Development takes time and requires a paradigm shift in the way we currently approach industrial development.
- New planning, design, business, and community development models and approaches are necessary.
- Opportunities are emerging and communities are exploring EID via green industrial parks, green manufacturing, and other green economy initiatives.
- There must be a continuum lead by champions followed by early adopters.
- Barriers abound; institutional, existing policies, human resistance to change, lack of resources, and main stream business drivers.
- It takes cross-jurisdictional collaboration to be successful.
- Resources from multiple public and private organizations are necessary.