The Eco-Industrial Footprint

Jobs, Resources, Environment - Cases for Business

Portland Metro Brownbag Presentation
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Business Cases - Overview

1. (Re-) Defining Eco-Industrial Development - The Industrial System
2. Barriers to Sustainable Development
3. The Invisible Toolbox - Available Tools
4. Case Profiles - What works - What doesn't
   Kalundborg, Denmark - The Eco-Industrial Park Non-Model
   Devens, MA - Eco-Industrial Park & Sustainable Community
   Minneapolis, MN - Philips Eco-Enterprise Center - EIP under one Roof
5. Case Profile - Reducing The Footprint
   Munich, GER: Commercial Yards - Promoting urban SME
6. Case Profile - New Community Concepts
   Freiburg, GER: New Quarters - Putting Community First and Cars Last
7. Case Profile - Applied Eco-Tools
   Munich Riem: Great Tools - Limited Success
8. District Energy - Urban And Rural Solutions
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9. Management as the 'missing link'
10. Eco-Center. How to manage stakeholders, tools and resources

(Re-) Defining Eco-Industrial Development

EIP Definition (applies also to clusters & networks)

- *A **community** of manufacturing and service enterprises located together on a common property*
- *Members seek enhanced environmental, economic, and social performance through **collaboration** in managing resources*



Eco-Industrial Development - System Approach

❑ Circular Economy

- **Maximum cycling** of resources and materials
- ‚Cradle to Grave' stewardship of products
- National Policy in Germany, Scandinavia, Japan and China

❑ Eco-Industrial Development

- **Industrial Ecology** as principle for the new economy
- **Eco-Industrial Parks and Clusters** as strategy to innovate
- **Eco-Industrial Networks** as key to system change

Limits of Existing Industrial Systems - Barriers for Business

❑ Environmental Policy Approach

- **regulation** is adding more cost than benefits
- **market** is distorting true cost to society
- **dissemination** of best practice prevented by weak tools

❑ Lack of Integration

- **tools** made for individual companies, not systems
- **networking** is done by sector, not by region
- **individual** technologies vs. **holistic** approach

❑ Waste Management and Recycling

- **end-of-pipe thinking** still prevailing
- **companies** act individually, not as industry
- **best available technologies** not widely adapted
- **Circular Economy** not yet anchored in society

Limits of Existing Industrial Systems - Barriers for Government

❑ Policy Approach

- **regulation** is still sectoral, not systematic
- **taxing** is on pollution & labor, not on resources
- **dissemination** of best practice prevented by weak tools

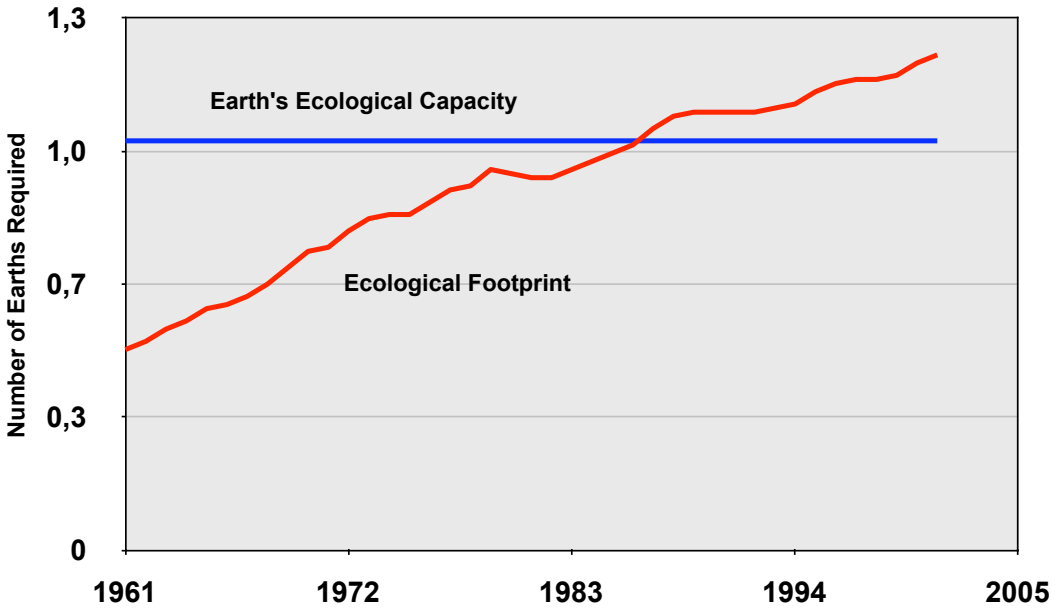
❑ Planning Approach

- **expansion** is basis for resource planning
- **infrastructure** is based on 50 year old principles
- **systems** are designed, not managed

❑ Role of Government

- **paradigm** of government role is shifting
- **markets** for resources and land not sustainable
- **management** not a government function (?)

World Ecological Footprint, 1961-2001



Source: WWF, UNEP, Global Footprint Network

WORLDWATCH INSTITUTE

Climate Change and Financial Crisis are not the Problem ...

.... they are Symptoms of the Problem

Available Tools for Eco-Industrial Systems (1)

❑ Tools for Infrastructure

- **district energy, renewables, efficiency**
- sewage treatment plants (STP)
- water reuse system
- integrated waste management system
- hazardous waste treatment center
- **common chemical storage**
- material exchange, recycling center
- estate-based emergency services
- **public transport**
- cluster-wide logistics systems
- **recreation, health and social services**

Available Tools for Eco-Industrial Systems (2)

❑ Tools for Standards

- Environmental Services
- Environmental Impact Assessment (EIA)
- Environmental Management Systems - ISO 14001 / **ISO 14031**
- Energy Audits
- **Technology Assessment**
- supply chain management
- SD reporting – Global Reporting Initiative
- **Safety & Health Standards**
- Emergency Preparedness – APELL
- Responsible Care (chemical industry)

Available Tools for Eco-Industrial Systems (3)

❑ Tools for Design

- **Green Buildings**
- Zero-Emission Concepts
- **Biotope buffer zones**
- Greening the supply chain
- **Ecological Footprint**
- Sustainable Products

Available Tools for Eco-Industrial Systems (4)

❑ Tools for Cooperation

- information exchange: **EID Center / Eco- Center**
- **Managers Club**, Business Forum as platform for networking
- **Stakeholder Roundtable**
- Joint activities: collective landscaping, **training**, health care, transportation & **logistics**, linked emergency services
- Material exchange systems / Industrial Symbiosis

Available Tools for Eco-Industrial Systems (5)

- Networking: Hardware & Software

Hardware

- physical connections between companies
- no '*virtual*' networks, synergies must be real exchanges

Software

- social and business networks
- close ***mental distance*** and ***trust*** between actors and stekeholder

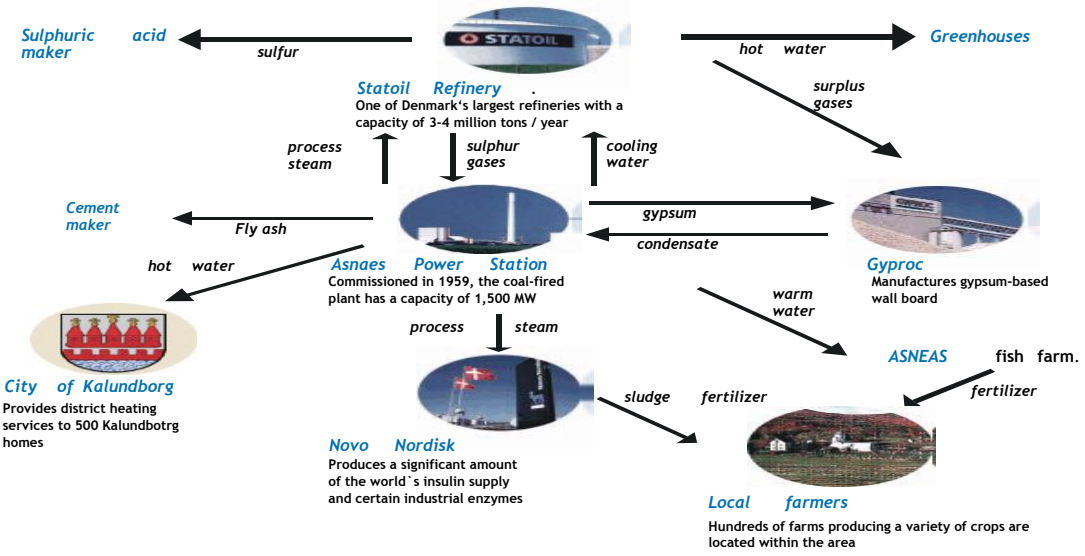
Imagine ...

.... our Knowledge about Sustainable Management, Lean Production, Logistics, Renewable Energy, Environmental Management, Green Design ....

... being designed into the urban - industrial system

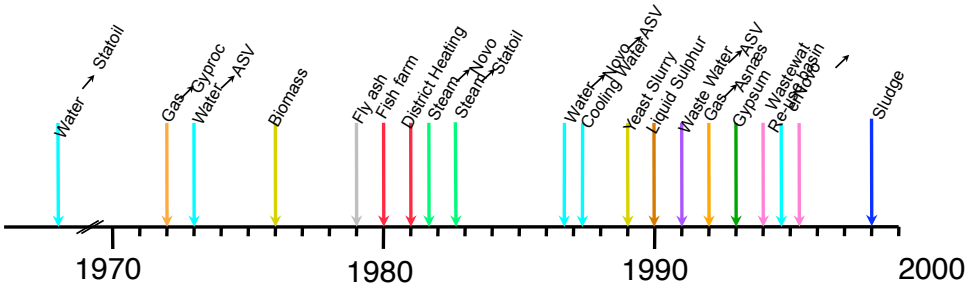
Kalundborg, Denmark - The Eco-Industrial Park Non-Model

- Large companies in a small town
- No system design
- No government involvement
- Symbiosis Institute as 'Gate Keeper'
- many projects not implemented
- 30 year development



Kalundborg, Denmark - The Eco-Industrial Park Non-Model

- **Kalundborg - the Non - EID Model**
  - Network of exchanges was not planned, no central management
  - No government involvement (city is system partner)
  - Symbiosis Institute focal point, only created recently
  - activities were driven by economics, not environment
  - many projects not implemented due to some economic obstacles

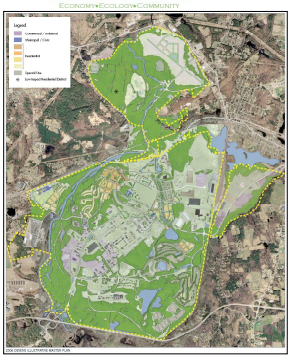


Devens, MA - Eco-Industrial Park & Sustainable Community

- Devens Sustainable Community
- Eco-Industrial Park
- State as Driver for Economy
- Business Engagement Tools
- No systems design, but systems thinking
- Staff continuity




- ❑ **Redeveloped Army Base near Boston**
- ❑ **Currently approximately 90 businesses**
  - 70 % small-medium enterprises
  - Mostly industrial - manufacturing, distribution, recycling
- ❑ **Major New Investment 2007/2008:**
  - Bristol Meyers Squibb Pharmacutical Complex
  - Evergreen Solar Photovoltaic Panels
  - Largest Construction Recycling Facility in North America
- ❑ **Major Success Factors:**
  - 45 day permitting (vs. 18 Months)
  - Sustainable image and active industrial community
  - (**EcoStar** Program)



Minneapolis, MN - Philips Eco-Enterprise Center - EIP under one Roof

- ❑ **First Eco-Industrial Building**
  - High-Efficient Industrial Facility
  - LEED-Certified Green Building
  - SME production space
  - Industrial space in low-income area
- ❑ **EID-Center for City and State**
  - Hub for several new projects
  - NGO Operates Recycling & Reuse system

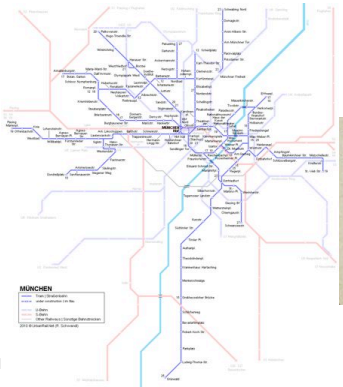
Financial Benefits:

EID Characteristic	Developer Capital Cost Differential	Resulting Annual Return to Tenants*	Resulting Annual Return to Developer*	Combined Developer & Tenant Payback*	Combined Developer & Tenant IRR*
Sum of Occupant Health Features	$ 144,000	$ 43,000		3.3	29.8%
Ground-source heat pump	$ 48,000	$ 6,500		7.4	12.4%
Air-to-air energy recovery system	$ 6,000	$ 700		8.6	10.1%
Efficient lighting and controls	$ 10,000	$ 3,500		2.9	35.0%
Energy management system	$ 36,000	$ 4,000		9	9.4%
Salvaged material installations	$ (20,000)	None		Immediate	NA
Native landscaping	$ (55,000)	$ 3,500		Immediate	NA
Active skylights (energy)	$ 90,000	$ 5,000		18	1.1%
Lease premiums*	$ 169,000	$ (39,700)	$ 39,700	4.3	23.3%
Totals	$ 168,500	$ 26,500	$ 39,700	2.5	39.3%

Portland, OR & Munich, Germany: **The Footprint**

Portland		**Munich**	
Area	376 sq Km	Area	310 sq Km
Population	568.380	Population	1.326.807
Population Density	1633 / sq Km	Population Density	4274 / sq Km

Portland, OR & Munich, Germany: **The Footprint**



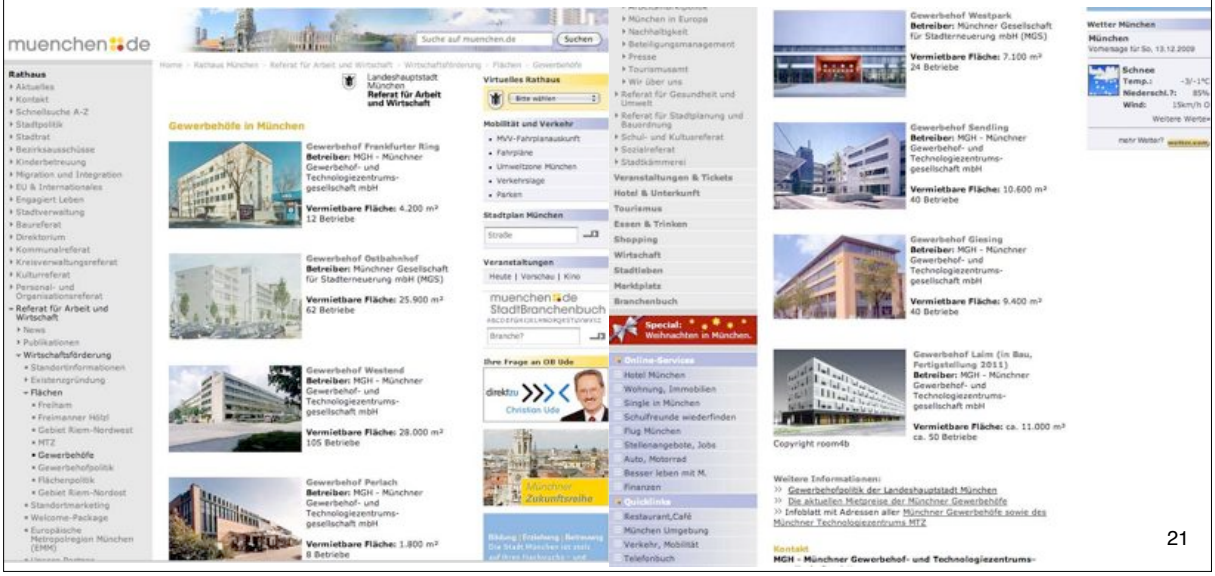
Munich, Germany: **Commercial Yards** - Promoting Urban SME

MGH

Landeshauptstadt München
Referat für Arbeit und Wirtschaft

Munich Technology Center

Munich Commercial Yards



Freiburg, Germany: New Quarters - Putting Community First and Cars Last

Rieselfeld Greenfield Urban Development

Freiburg, Germany: New Quarters - Putting Community First and Cars Last

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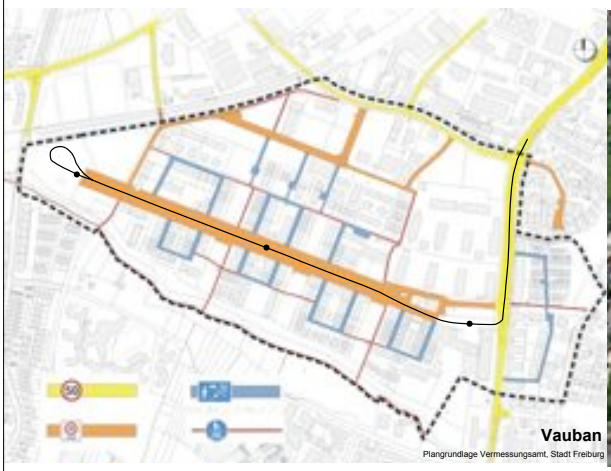
Vauban Army Base Re-Development



Freiburg, Germany: New Quarters - Putting Community First and Cars Last

Vauban Army Base Re-Development

Munich Riem: Great Tools - Limited Success

Munich Riem Airport Redevelopment

Munich Riem: Great Tools - Limited Success

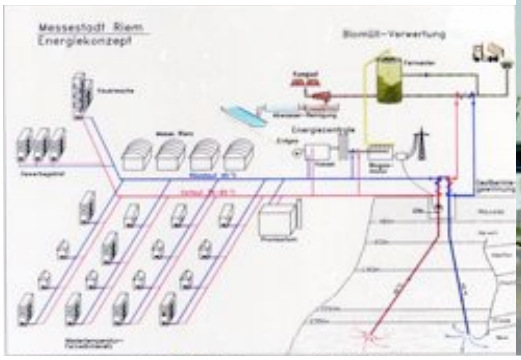
Design Guidelines – Ecological Tools

Landeshauptstadt München
Referat für Stadtplanung und Bauordnung

Messestadt Riem

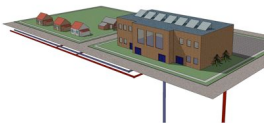
Munich Riem: Great Tools - Limited Success

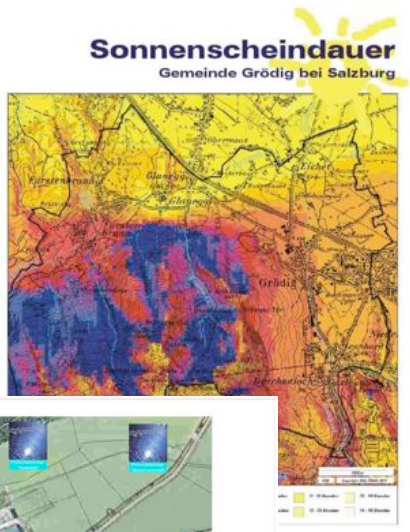
Messestadt Riem

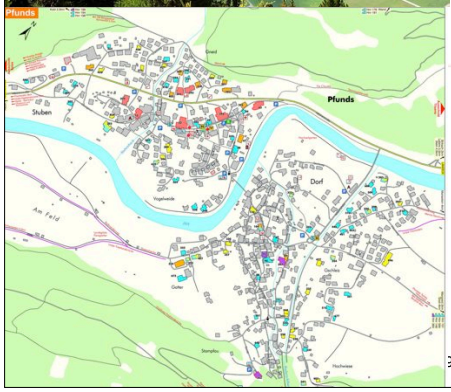


Tirol, Austria, Juende and Freiburg, Germany

Pfunds, Tyrol - Austria: Energy Driven Preservation

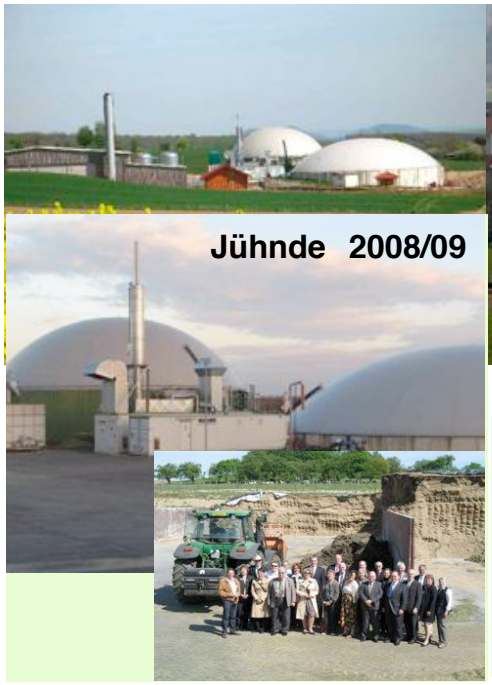


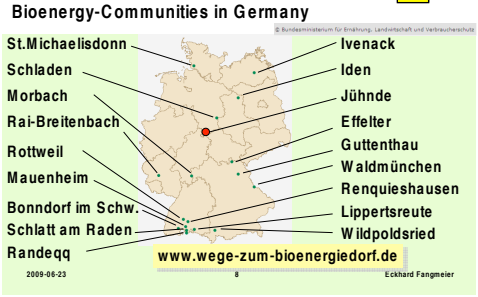




Tirol, Austria, Juende and Freiburg, Germany

Juende Energy Village Village - Biomass District Energy





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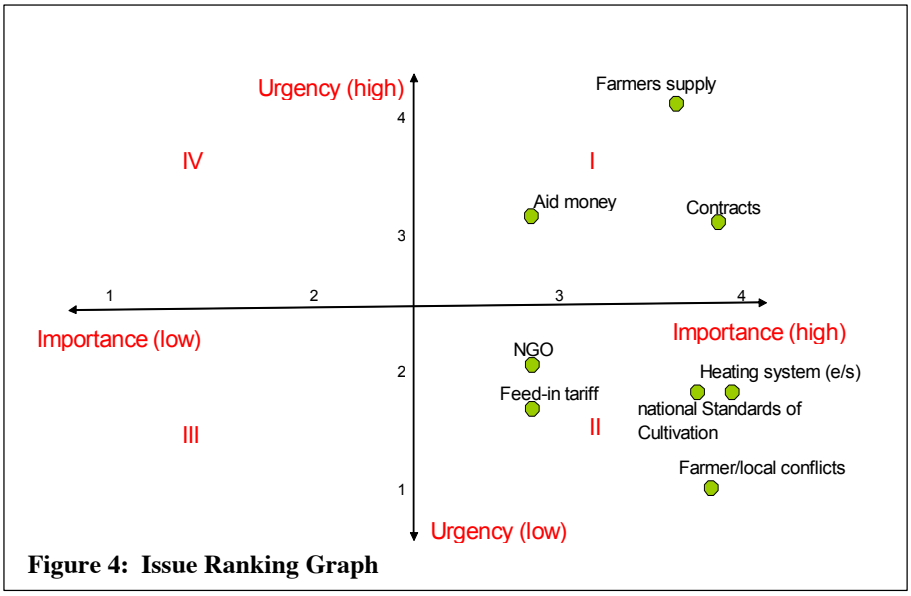


Figure 4: Issue Ranking Graph

Tirol, Austria, Juende and Freiburg, Germany

Freiburg Solar Village - New District Energy Concept

System - Wide Approach (1): Material & Resources System

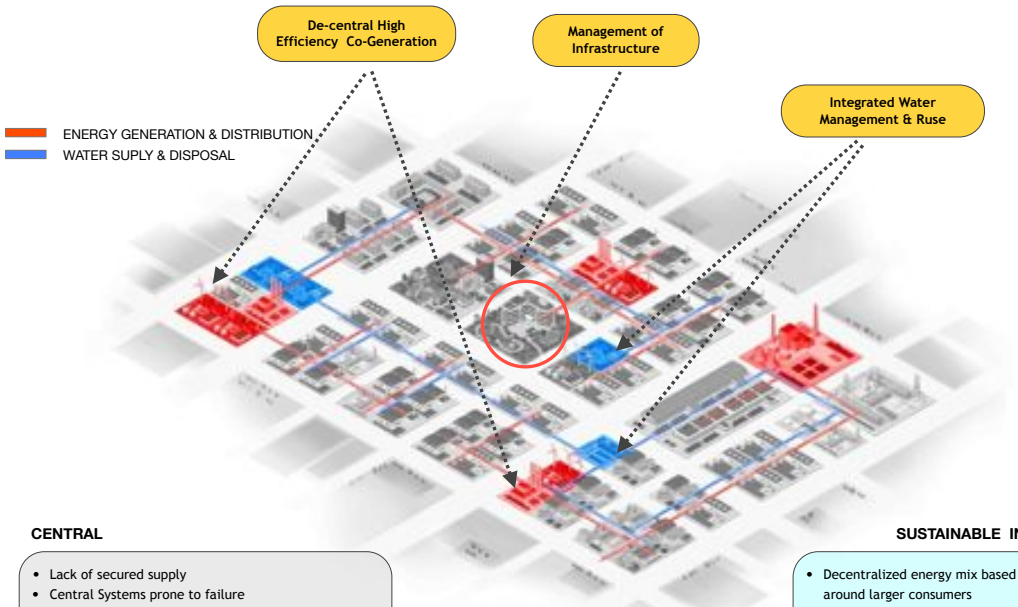
WASTE MANAGEMENT

- Lack of efficient collection system
- Many collectors from outside the park / system
- Resource Recovery *possible* but not *optimal*
- Company-based, individual solutions
- No cooperation between recycling facilities
- Increased investment and cost due to redundancy in waste treatment system & infrastructure

MATERIAL FLOW

- System level information about resources & highest value
- Managed collection and logistics system
- Reduced cost through joint recycling & storage
- System-Level optimization of environmental management
- Co-location improves cooperation & stakeholder

System - Wide Approach (2): Energy & Industrial Infrastructure



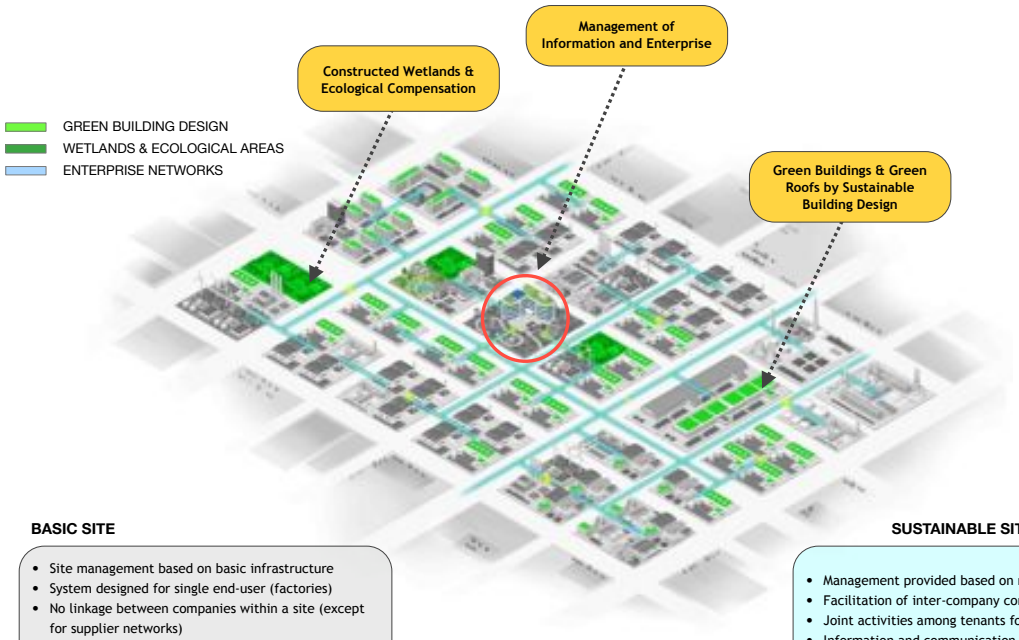
CENTRAL

- Lack of secured supply
- Central Systems prone to failure
- Back-up systems expensive and inefficient
- Energy supply at 45-50% Efficiency (Coal-Fired)
- Water supply inflexible & inefficient (transfer system loss)

SUSTAINABLE INFRASTRUCTURE

- Decentralized energy mix based on block networks around larger consumers
- Utilization of renewable energy sources (Biomass / Solar / Wind) & co-generation Plants (85% efficiency)
- Water reuse and recycling systems reduce cost
- Constructed wetlands for treatment & storm water management
- Company based energy & water efficiency programs

System - Wide Approach (3): Management & Green Design



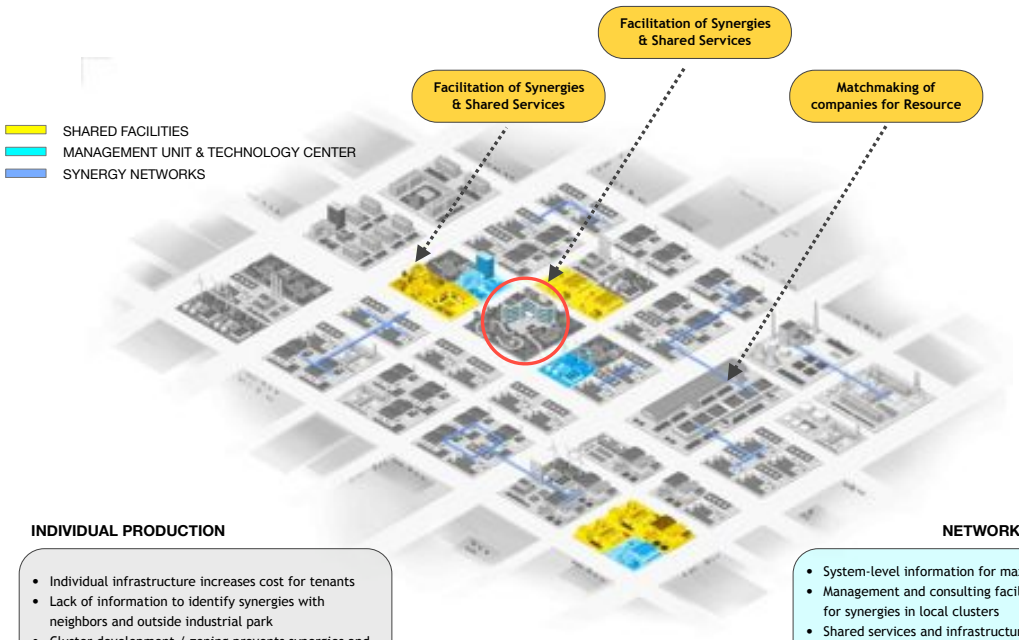
BASIC SITE

- Site management based on basic infrastructure
- System designed for single end-user (factories)
- No linkage between companies within a site (except for supplier networks)
- Security services only provided in fenced sites
- Utilities and services mostly off-site
- few or no joint activities among tenants

SUSTAINABLE SITE MANAGEMENT

- Management provided based on needs of tenants
- Facilitation of inter-company communication
- Joint activities among tenants for better business
- Information and communication management
- Sustainable activities for continuous site improvement
- Green Design features for all industrial sites and installations to decrease ecological impact

System - Wide Approach (4): Services & Synergies



INDIVIDUAL PRODUCTION

- Individual infrastructure increases cost for tenants
- Lack of information to identify synergies with neighbors and outside industrial park
- Cluster development / zoning prevents synergies and lacks common facilities

NETWORKED PRODUCTION

- System-level information for maximum of synergies
- Management and consulting facilitates opportunities for synergies in local clusters
- Shared services and infrastructure reduces cost at company level (e.g. common storage area)
- One-Stop Services are provided based on tenant needs
- Technical and legal assistance for match-making contracts

Eco-Centers: Hubs For Sustainable Innovation

- Eco-Industrial Development Centers
  - are multi-functional facilities
  - catalyze and facilitate EID
  - provide sustainable development & environmental services
  - support awareness about sustainable development
  - function as a hub for company networks
  - are ideally located in Eco-Industrial Parks and near Resource Recovery Centers

Eco-Centers: Management & Services for Industrial Systems

ENERGY CLUSTERS
Provide flexible, efficient and renewable energy through local interlinked systems

URBAN & GREEN DESIGN
Integration of Industry and Urban Areas

ECO-CENTER
Management & Services
Information & Consulting

SUSTAINABLE COMMUNITY
Cooperation among companies to increase sustainable performance of industrial park

RESOURCE RECOVERY PARK
Integrated into Industrial Network

SERVICE FACILITIES
One-Stop Service integrated into industrial community

INDUSTRIAL PARK

- Old sites outdated, less organized, often no management
- New sites in rural areas, not integrated in local economy
- Zoning based on site structures, not on co-location
- Provides basic Infrastructure and Management

ECO-INDUSTRIAL PARK

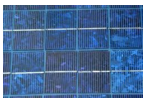
- Designed or Redeveloped to sustainable standards
- Decentralized, efficient infrastructure
- Embedded into local economy and environment
- Provides Full-Service through stakeholder cooperation
- Helps establish industrial community through networking
- Eco-Center manages information, material flow, synergies
- Serves as information platform for sustainable development throughout the region

Eco-Centers: Hubs For Sustainable Innovation

Eco-Center Multi-Function Concept

TRAINING & RESEARCH
MANAGEMENT & CONSULTING
ENVIRONMENTAL EDUCATION
SEMINAR & CONFERENCE

RENEWABLE ENERGY



CONSULTING & SERVICES

TRAINING & SEMINAR

MANAGEMENT & FACILITIES

TECHNOLOGY DISPLAY

TECHNOLOGY SHOWCASE

GREEN BUILDING DESIGN

..... always start with a Vision

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Thank You

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