Eco-Industrial Parks
Strengthening Our Regional Economy in Response to Climate Change and Resource Scarcity

Dr. Daniel Christian Wahl
Sustainable Design Consultant
Programme Development
Research & Education

Findhorn College
&
CIFAL Findhorn
&
Centre for the Study of Natural Design
University of Dundee

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Horizon Scotland
Forres, Moray
Introduction

- Context
- Decoupling Growth (Wealth) and Resource Use
- Sustainable Business Clusters and Regional Economic Development
- Industrial Ecology & Industrial Symbiosis
- Eco-Industrial Parks
- The Moray Eco-Industrial Park & The Moray 2020 Vision
General Trends of Development

- Economic growth
- Energy demand
- GHG emissions
- Local pollution

Source: H. Brattebo 2004
Reduced Fossil Fuel Availability result in Increased Fossil Fuel Costs

Global Oil Discovery and Demand

In the Case of the UK

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An example of the challenge

Gas discoveries required at current growth in consumption rates

Doubling timescale - every 25 years, *Meadows et al, 2004*

Source: Brian Menzies

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Other Key Resources that are running out:

- Antimony 15-20 years
- Silver 15-20 years
- Hafium about 10 years
- Tantalum 20-30 years
- Indium 5-10 years
- Uranium 30-40 years
- Platinum 5-10 years
- Zinc 20 - 30 years

Source: New Scientist, 26 May 2007
Irregular Weather Patterns are causing floods, droughts, storm events

- higher risk for production safety
- higher cost for remediation

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Global trends in major greenhouse gases; source: NOOA

Global fossil carbon emissions since the Industrial Revolution; source: CDIAC

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55% Reduction by 2030
to keep temperature rise to 2-3 degrees C
30 year delay emissions to GHG effect

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Is Smart (Green) Growth Possible?

Source: EU Thematic Strategies on the Use of Natural Resources - stakeholder meeting (January 2006) - provided by Brian Menzies

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Factor X: More Wealth, Less Resource Consumption, Less GHE & Pollution

- **Factor 4-10**: Objective for increase of resource productivity introduced by Weizsäcker 1995, Schmidt-Bleek 1992
- **Quantitative Targets**: Germany (*Factor 2*, 1994-2020)
  - Japan (40%, 2000-2010)

Source: Stefan Bringezu

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Waves of Innovation

- 1st wave: Iron, Water power, Mechanisation, Textiles, Commerce
- 2nd wave: Steam power, Railroad, Steel, Cotton
- 3rd wave: Electricity, Chemicals, Internal combustion engine
- 4th wave: Petrochemicals, Electronics, Aviation Space
- 5th wave: Sustainability, Radical resource productivity, Whole system design, Biomimicry, Green chemistry, Industrial ecology, Renewable energy, Green nanotechnology
- 6th wave: Digital Networks, Biotechnology, Software Information technology

Source: Natural Edge, 2004

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The Problem

- Economic development and environmental values are often seen as in conflict

- Industry/manufacturing consumes natural resources, water and energy and generates waste

- Transportation and logistics can restrict industrial development in remote/rural areas

- Expertise to address these problems is scattered and poorly utilized


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The Solution

• Industrial processes can be linked systematically to reduce consumption of raw materials, water and energy

• Industrial waste can become raw material for linked businesses

• Businesses can be clustered in eco-industrial parks to reduce waste and transport costs while simplifying logistics

• Expertise can be applied on a case-by-case basis


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Forum for the Future & Regional Futures Report 2004: Sustainable Business Clusters in the Regions

**How do sustainable business clusters profit business and the region?:**

1. “By developing new businesses through waste reuse and recycling whilst also saving on waste disposal costs.” (p.3)
2. “By increasing human and social capital from working with local communities and enhancing the local landscape.” (p.3)
3. “By decreasing transport costs through the sharing of freight costs, and by collectively demanding higher standards from suppliers who are then encouraged to deliver better quality products.” (p.3)

**Definition:**

“A Business cluster is a geographic concentration of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a nation or a region” (Michael Porter, Harvard Business School)

**Examples:**

IT cluster in Silicon Valley, California; film industry cluster in Hollywood, California; biotechnology cluster around Cambridge, UK …

**There is a high potential to create a sustainable business cluster focused around the food industry, agriculture, timber and sustainable construction “know-how & show-how”, as well as sustainability research and education in Moray!**

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Industrial ecology - a framework for examining and creating industrial sustainability

Industrial systems as embedded within nature, not isolated from them

TOOLS
- Material flow analysis
- Life-cycle assessments
- Industrial symbiosis

Source: Prof. Marian Chertow, 2006

Graedel 1996
Definitions:

**Industrial Ecology** “is principally concerned with the flows of materials and energy through systems at different scales, from products to factories and up to national and global levels.”

**Industrial Symbiosis** “focuses on these flows through networks of businesses and other organizations in local and regional economies as a means of approaching ecologically sustainable industrial development.”

Prof. Marian Chertow, 2004
What is Industrial Symbiosis?

Business copying nature

Symbiosis is defined as “the coming together of dissimilar organisms in a mutually beneficial relationship”

• Simply put – “one mans waste is another's raw material”

• Not exclusive to a particular resource (waste). It can include: Raw-materials, energy, logistics, human resources, water, investment

Source: NISP, 2005

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Multiple Benefits of Industrial Symbiosis

Industrial Symbiosis

Business Opportunity

Landfill ↓
Jobs ↑
New Business ↑
CO₂ ↓
Sales ↑
Costs ↓

Learning ↑
Innovation ↑
Transport ↓
Pollution ↓
Asset Utilisation ↑

Source: Laura Burnett, Thirdwave Scotland

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Four Principles of Industrial Ecology

I. Creating Cyclical Resource Flows - material recycling and energy cascading

II. Creating Diverse Industrial Eco-Systems - wide variety of businesses and economic actors

III. Adapting Industry to its Locality - focus on use of regional natural resources and local cooperation

IV. Gradual Change - once established, systems diversity develops slowly

Adapted after: J. Korhonen, 2001
Designing for Regional Resource Use and Reuse

Source: Peter Harper, CAT, 2007
The UK National Symbiosis Programme

**NISP** has:
- helped to divert over 2.95 million tonnes of industrial waste from landfill
- attracted over £75.1 million of private investment in reprocessing/recycling
- eliminated 338,000 tonnes of hazardous waste
- generate £119 of new sales among its members
- create 618 new jobs and safeguarded an additional 807
- reduced CO2 emissions by over 2.9 million tonnes

**SISP**
In 2006-07 SISP introduced 485 member organizations to the concept of industrial symbiosis, reaching 1035 Scottish member companies.

www.nisp.org.uk

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Eco-Industrial Parks (EIPs)

An Eco-Industrial Park is “a community of manufacturing and service businesses seeking enhanced environmental and economic performances through collaboration in managing environmental and resource issues including energy, water, materials … the community of businesses seeks a collective benefit that is greater that the sum of the individual benefits each company would realize if it optimized its individual performances.”

Lowe and Warren, 1996

Co-location is a key to optimizing the synergistic and symbiotic whole systems design!

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Planning for New Eco-Industrial Parks

- Participatory Planning with Community Involvement
- Planning of ‘best practice’ and build-in synergies
- Selling at a premium for first-class work and living environment

Source: EcoIndustry
A. Koenig, 2007
Characteristics of Supporting Infrastructure

Eco-industrial Site characteristics:
- Area of eco-industrial sites: 4 to over 4000 acres - mean of 580 acres.
- Employment: 20 to 4,000 - mean of 951.
- No. of firms: 3 to 760 - overall sample mean of 91.

Slide provided by: Brian Menzies

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Industrial Symbiosis: The Classical Example
(not representative)

Kalundborg

Regional Resource Management

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Slide Source: Stefan Bringezu Wuppertal Institute 2008
Examples of Eco-Industrial Parks in the US

ENERGY-BASED
- Red Hills Ecoplex
  Choctaw County, MS

ENVIRO TECH
- Phillip Eco-Enterprise Center
  Minneapolis, MN

HYBRIDS
- Riverside Eco-Park
  Burlington, VT

MATERIALS RECOVERY
- Cabazon Resource Park
  Indio, CA

ECO-PARK
- Chicago Center for Green Tech
  Chicago, IL

- Fort Devens
  Devens, MA

ACTIVE PROJECTS
- Alaska
- Arizona
- California
- Indiana
- Illinois
- Louisiana
- Massachusetts
- Michigan
- Minnesota
- Mississippi
- Nebraska
- New Hampshire
- New Mexico
- North Carolina
- Oregon
- Texas
- Vermont
- Virginia

Source: Jerry Hembd, 2007

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Design for Intervale Eco-Park, Burlington, VT

Integrated Food Production at The EcoPark

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Design for Intervale Eco-Park, Burlington, VT
Brewery Waste - Mushrooms - Worms - Fish - Salads / Vegetables

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The Welsh Example: CAT, Dyfi Eco-Park, WISE, Dyfi Valley
The Moray Eco-Industrial Park
The Moray 2020 Delivery Strategy?

Strategy Aim: “To create a higher value and more robust economy with wider range of opportunities and pay” (p.40)

Strategy Elements: “Sustainability North” (p.43) SDR / National Centre for Sustainability
“Moray Timber Industry Conference” (p.46)
“Sustainable Design and Construction in Northern Climates Centre” (p.46)
“Support for Manufacturing and Engineering” (p.47)
“Support for Tourism” (p.47)
“Encouraging Entrepreneurial Development” (p.51)
“Growing Businesses of Scale: Promoting Management Excellence” (p.52)
“Promoting Technology Development” (p.53)

Vision Themes:
“Strengthening Moray’s Infrastructure” (p.29)
“Developing our Key Sectors” (p.29) - food&drink, agriculture, timber, engineering, tourism
“Developing Moray as a Place of Learning” (p.30)
“Realizing the potential in Moray to pioneer niches in the sustainable development agenda” (p.30)

Source: Moray 2020, HIE Moray & Moray Council, December 2005

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Thank You! - Any Questions?

Contact:

Dr. Daniel Christian Wahl
Design for Sustainability Consultancy
Programme Development
Research & Education

designforsustainability@gmail.com

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The Moray Eco-Industrial Park: Food for Thought

- Hydrogen Cars & Trucks
- Whiskey Distillery
- Shitake Mushrooms
- Worm Production
- Brewery
- Food Processing Plant
- Aquaculture Fish-Farm
- Horticulture in Green/Hot Houses
- Ecological Waste Water Treatment
- Saw Mill
- Wood Pellet & Wood Chip Production
- Research & Development
- Forestry Commission Forests
- Saw Mill
- Timber Kit Home Producer
- Centre for Sustainable Construction & Design
- Wood Fired CHP Plant
- Sustainable Timber Products
- Education Demonstration Facility
- Bio - Gas Plant (Anaerobic Digestion)
- Sustainable Timber Products
- National Centre for Sustainable Development
- High-Grade Fertilizers
- Zero-Carbon Offices
- Central Canteen / Visitors Centre, Shop & Cafe
- Sustainability Consultancies
- Moray Farms and Diaries

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Multiple Benefits of Eco-Industrial Parks

- Reduction in energy & material inputs to the industrial system (increased plant/production efficiency)
- Reduction in waste and emissions output from industry
- Helps to generate revenue
- Within the Value Chain IE reduces costs and creates synergy between production and distribution
- Provides cost savings (energy, materials, waste management, compliance with environmental legislation)
- Reduces liabilities
- Gives a competitive edge (“green market” potential)
- Offers flexible responses to regulatory changes
- Enhances the public image of a companies in the cluster
- Early adopters can become new market leaders

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