Applying Industrial Ecology

A regional Industrial Symbiosis methodology and its implementation in Geneva, Switzerland

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1. Definitions and objectives

What is Industrial Symbiosis (or synergies)?

« *Industrial symbiosis engages traditionally separate industries in a collective approach* to competitive advantage involving *physical exchange* of materials, energy, water, and/or by-products. The keys to *industrial symbiosis* are *collaboration* and the synergistic possibilities offered by *geographic proximity* »

(Chertow, 2000)

« *By involving at least three entities, none of which is primarily engaged in a recycling oriented business*, a symbiosis begins to recognize complex relationships rather than linear one-way exchanges »

(Chertow, 2007)
1. Definitions and objectives

What is Industrial Symbiosis (or synergies)?

![Diagram of industrial symbiosis]

**Utility sharing**
- Mutualized supply

**By-product exchanges**
- Flow substitution

**Company A**
- Flow 1
- Flow 4
- Flow 6
- Flow 9
- Flow 11

**Company B**
- Flow 1
- Flow 2
- Flow 3

**Company C**
- Flow 2
- Flow 5
- Flow 7
- Flow 8
- Flow 10
- Flow 9
- Flow 8
1. Definitions and objectives

Pertinence of IS for increasing efficiency in industrial systems

- Cascading the use of material to divert it from disposal or incineration
- Convince companies to switch to the best environmental solution
- Relocating material flows by encouraging direct local reuse

Waste hierarchy (Kijak, 2004, modified)
1. Definitions and objectives

Pertinence of IS for increasing efficiency in industrial systems

- State of Geneva
- Switzerland
- Europa
- Rest of the world

Spacial compactness vs Process efficiency

DISPOSAL, INCINERATION, ENERGY RECOVERY, DOWNCYCLING, RECYCLING, REUSE
2. Regional policy context

Law introducing industrial ecology

Local Agenda 21 adopted in 2001:
«Law on public action towards sustainable development»

Article 12 (ECOSITE):
«The State facilitates possible synergies between economic activities in order to minimize their environmental impacts.»

Advisory committee for Industrial Ecology and Industrial symbiosis implementation involving the waste treatment, energy, regional industrial planning, building and economic state services.
3. Methodology for detecting potential synergies

- Regional context analysis (regional industry & environmental policy)
- First contact with companies
- Physical input-output analysis & face-to-face meetings
- Detection of by-product exchanges & utility sharing potentials
- First feasibility analysis (quantitative, qualitative, geographical, economic, environmental factors)
- Individual report to companies
- Multi-stakeholder meeting including public and private partners
- Further collaborative technical analysis for implementation
- By-product exchange or utility sharing implementation & monitoring

Search for new potential partners
3. Methodology for detecting potential synergies

**Presteo© tool:** developed by Systèmes Durables

Main function:
- Database tool crossing input-output data from companies
- Systematic or deductive approach

Methodology for flow description: 2 data levels
- Use of precise flow and components rules and formalism
- **Flow** = matter or energy flow entering or leaving a company in a particular form
- **Component** = basic elements constituting a flow
- More than 1400 flows and components currently listed in Presteo© database

Source: Systèmes Durables - C.Adoue
4. Potential synergies detected

Status of the project (beginning 2007):

- 800 flows described
- Potential synergies found for 17 flows
- Regional development potential (new activities)
- Industry highly interested in the IS project
- Strong impact thanks to legal basis and institutional support
4. Potential synergies detected

Potential by-product exchanges between industrial sectors
4. Potential synergies detected

Building material exchange network

Potential for new activity: creation of a common crushing-calibration platform for recycling concrete (Building material)
4. Potential synergies detected

Cooling water & energy exchange networks

Spatial buffer: 2 km
4. Potential synergies detected

Common treatment for cutting fluids reuse

Potential for new activity: creation of a common regeneration plant using centrifugation.
5. Evaluation of environmental benefits using LCA

Common treatment for cutting fluids reuse:

*Using LCA to compare scenarios (Functional unit: 3 uses of 1 m³ of cutting fluid containing 5% mineral oil)*

**Scenario 0:**
Oil transportation from Rotterdam
→ Single uses (3)
→ Incineration

**Scenario 1:**
Oil transportation from Rotterdam
→ 50% of oil regenerated after each use for 3 uses
→ Incineration of the other 50%

**Scenario 2:**
Oil transportation from Rotterdam
→ 100% regenerated 3 times
→ Incineration after 3 uses

![Damage assessment (Impact 2002+)]
6. Perspectives

**Short term:**
- Implementation of the highest number of synergies
- Find new local industrial actors regarding first phase results to develop the networks
- Prove the environmental usefulness of the project

**Mid and long term:**
- Export methodology and tools to other regions
  (In progress in Lausanne)
Thank for your attention!

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