Industrial Symbiosis as a tool for sustainable development

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European Union (EU-27)

- Biomass (141 million tonnes)
- Manufactures (212 million tonnes)
- Fuels/mining products (215 million tonnes)

EU-27 exports (2011)

EU-27 imports (2011)

Total trade from EU-27 to ROW
- in 1999: 397 million tonnes
- in 2008: 536 million tonnes
- in 2011: 568 million tonnes

Total trade from ROW to EU-27
- in 1999: 1 340 million tonnes
- in 2008: 1 798 million tonnes
- in 2011: 1 629 million tonnes
Circular Economy

- Extraction of natural resources
- Eco-design of products
- Manufacturing
- Distribution
- Product use
- Reuse, recycling, recovery
- Waste collection
- Disposal
Industrial Symbiosis

What is Industrial Symbiosis?

*The sharing of services, utility, and by-product resources among industries in order to add value, reduce costs and improve the environment*

There are **three** primary sectors for resource exchange:

- By-product and waste exchange
- Utility/infrastructure sharing such as energy, water, and wastewater
- Joint provision of services - meeting common needs across firms for ancillary activities such as fire suppression.
Eco-industrial parks

An eco-industrial park is a community of manufacturing and service businesses located together on a common property. Members seek enhanced environmental, economic, and social performance through collaboration in managing environmental and resource issues.

Identified Industrial Parks

- UK: 9
- DE: 4
- SE: 3
- FR: 3
- AT: 2
- FI: 2
- DK: 2
- IT: 2
- NL: 1
The eSymbiosis project

Development of knowledge-based web services to promote and advance Industrial Symbiosis in Europe (LIFE09 ENV/GR/000300)

The project aims to develop a knowledge-based service that will promote, demonstrate and advance Industrial Symbiosis (IS) in Europe.

http://www.esymbiosis.gr/
The eSymbiosis project

The eSymbiosis project is implemented in the Prefecture of Viotia, a region close to Attica and the host of numerous industries.
Some examples of industries in the area

**Metallurgical industries 26%**

- Manufacture of basic iron and steel and of ferro-alloys
- Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
- Manufacture of basic precious and other non-ferrous metals
- Casting of metals
- Manufacture of structural metal products
- Treatment and coating of metals; machining
Some examples of industries in the area

**Chemical industries  20%**

- Manufacture of basic chemicals
- Manufacture of pesticides
- Manufacture of paints, varnishes and coatings
- Manufacture of soap and detergents
- Manufacture of basic pharmaceutical products
- Manufacture of rubber products
Some examples of industries in the area

**Food & Beverage Industry  11%**

- ✔ Processing & preserving of meat
- ✔ Processing & preserving of fruit & vegetables
- ✔ Manufacture of oils and fats
- ✔ Manufacture of dairy products
- ✔ Manufacture of grain mill products
- ✔ Animal feed production
- ✔ Manufacture of soft drinks
Waste, LoW, By-products, EoW criteria

Directive 2008/98/EC:

**Waste** means any substance or object which the holder discards or intends or is required to discard

**List of Waste:** Decision 2002/532/EC

**By-products** – Article 5(1) 2008/98/EC

**End-of-Waste criteria** – Article 6(1) and 6(2)
List of Waste LoW

The List of Waste is meant to be a reference nomenclature providing a common terminology throughout the Community with the purpose to improve the efficiency of waste management activities.

The List of Waste serves as a common encoding of waste characteristics in a broad variety of purposes like classification of hazardous wastes. Assignment of waste codes has a major impact on the transport of waste, installation permits (which are usually granted for the processing of specific waste codes), decisions about recyclability of the waste or as a basis for waste statistics.
By-product

According to Article 5 par. 1:

"a substance or object, resulting from a production process, the primary aim of which is not the production of that item, may be regarded as not being waste but as being a by-product only if the following conditions are met:

✓ further use of the substance or object is certain;
✓ the substance or object can be used directly without any further processing other than normal industrial practice;
✓ the substance or object is produced as an integral part of a production process; and
✓ further use is lawful
According to Article 6:
"...certain specified waste shall cease to be waste when it has undergone a recovery, including recycling, operation and complies with specific criteria to be developed in accordance with the following conditions:

- the substance or object is commonly used for specific purposes,
- a market or demand exists for such a substance or object;
- the substance or object fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- the use of the substance or object will not lead to overall adverse environmental or human health impacts"
### Accomplished Technical studies and Adopted Regulations on EoW criteria

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<tr>
<th>Waste Stream</th>
<th>Technical Study EoW</th>
<th>Regulation</th>
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<td><strong>2 Category I.1:</strong> Aluminium and Aluminium Alloy Scrap</td>
<td>«End-of-waste Criteria for Aluminium and Aluminium Alloy Scrap: Technical Proposals» (2010)</td>
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<tr>
<td><strong>3 Category I.1:</strong> Copper and Copper Alloy Scrap</td>
<td>«End-of-waste Criteria for Copper and Copper Alloy Scrap: Technical Proposals» (2011)</td>
<td><strong>Commission Regulation on EoW for copper scrap (715/2013)</strong></td>
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<td><strong>5 Category I.1:</strong> Glass</td>
<td>«End-of-waste Criteria for Glass Cullet: Technical Proposals» (2011)</td>
<td><strong>Commission Regulation on EoW for glass cullet (1179/2012)</strong></td>
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Waste from Metallurgic companies

- Scrap
- Batteries
- Packaging Waste
- Sludge from WWTP
- Filters
- Oils
Some examples of valorisation

- Scrap recycling
- Packaging waste recycling
- Batteries recycling
- Use of sludge as alternative fuel e.g. in cement industries
Waste from Food Industries

- Animal Byproducts
- Whey from dairy industries
- Pomace from oil olive production
- Fruit and vegetable waste
- Spent grains from brewing
- Packaging waste
- Sludge from WWTP
- Expired food
- Filters
Some examples of valorisation:

- Packaging waste recycling
- Use of sludge for composting and anaerobic digestion for biogas production
- Whey for whey protein production
- Pomace for the production of olive-pomace oil and wood pomace
- Spent grains from brewing for animal feed
- Damaged fruit and vegetables for composting or anaerobic digestion
- Animal by-products for collagen production, blood for production of bioactive compounds
Key issues for successful industrial symbiosis

- Industry leadership
- Willingness to cooperate
- Synergy development activities
- Spatial planning
- Design and choice of technology production
- Consideration of alternative production methods
- Existence of appropriate legislative framework and its proper implementation
- Awareness raising of the actors involved
- Funding and promotion.
Benefits

Environmental, social & financial benefits

- Emissions reduction
- Diversion of organic and industrial waste from landfills
- Resource savings
- Reduction of raw material cost through byproduct valorisation
- Extra revenues
- Economy boosting
- Development of new technologies for the recovery of waste
- Private Investment
- Jobs creation
Thank you for your attention

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