National Technical University of Athens
School of Chemical Engineering
Unit of Environmental Sciences and Technology

Industrial Symbiosis as a tool for sustainable development

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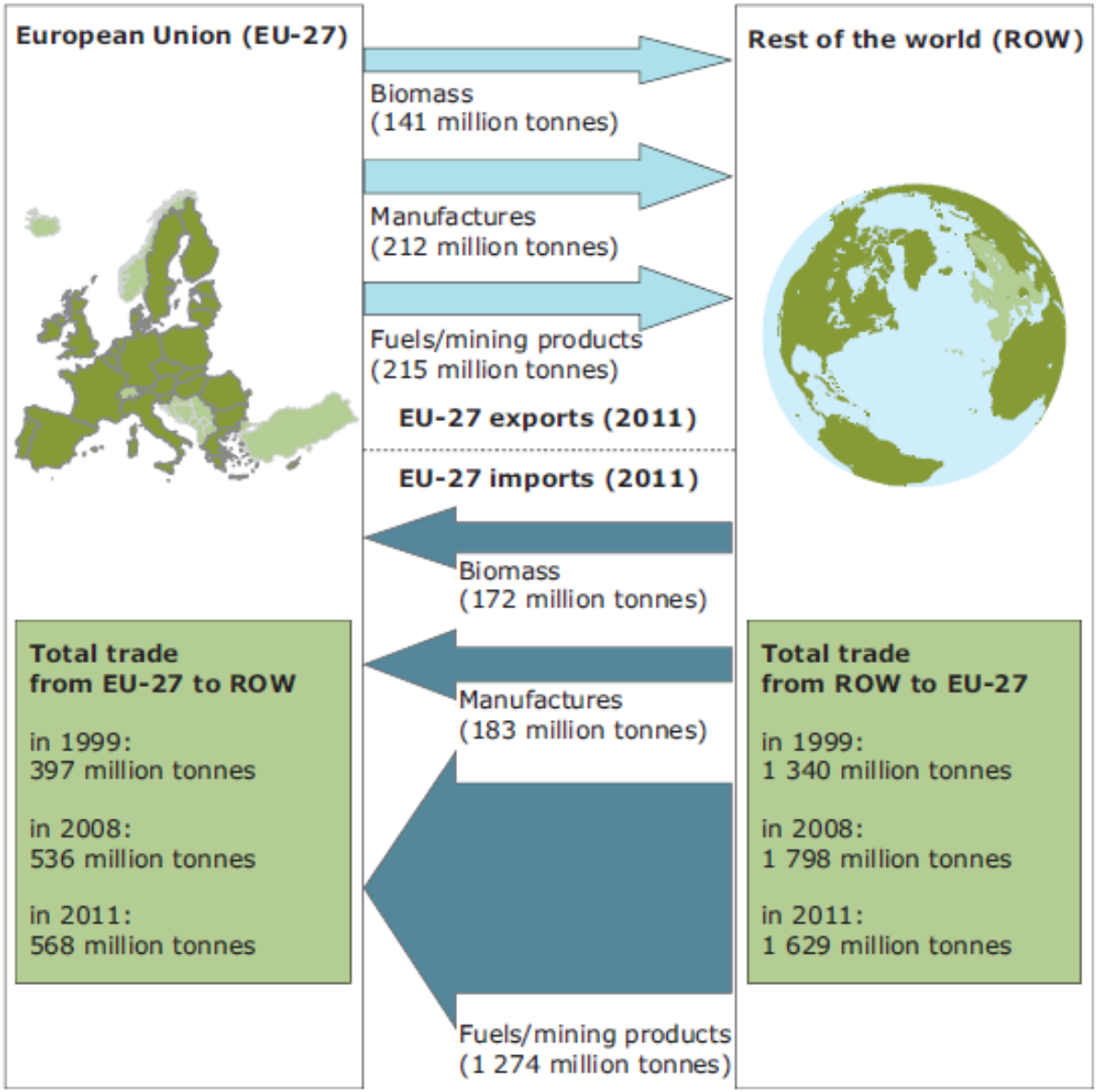
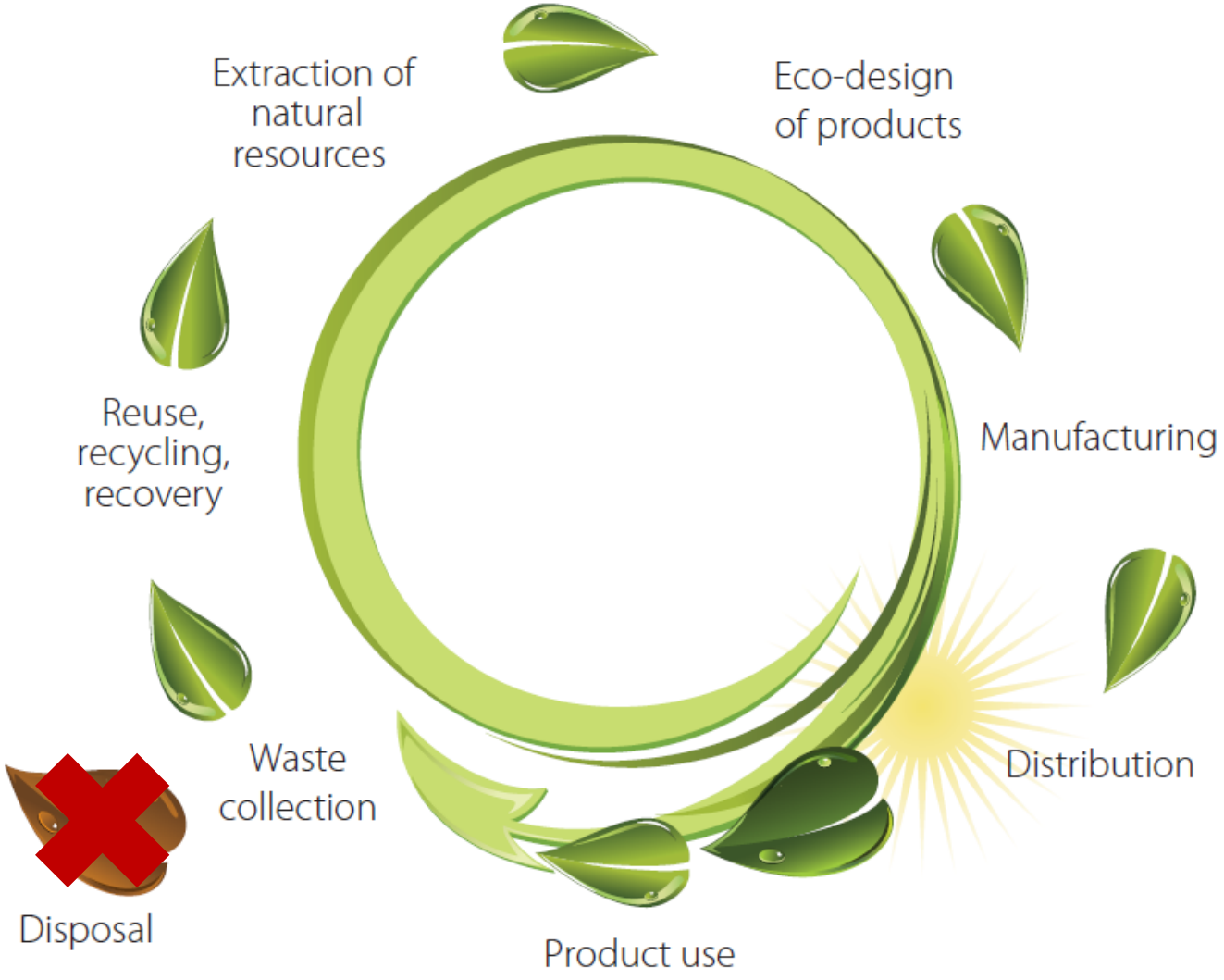
EU-27 physical trade balance with the rest of the world 2011



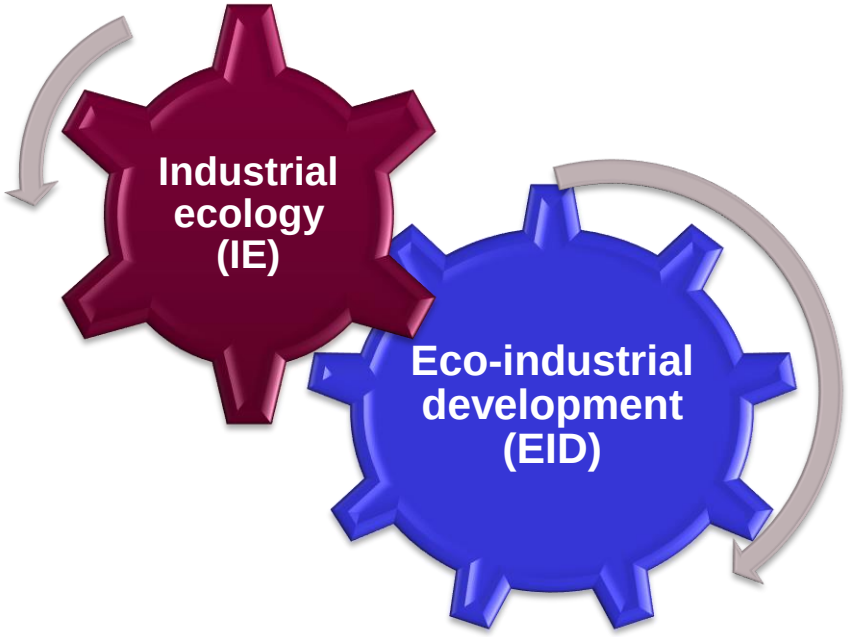
Circular Economy



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



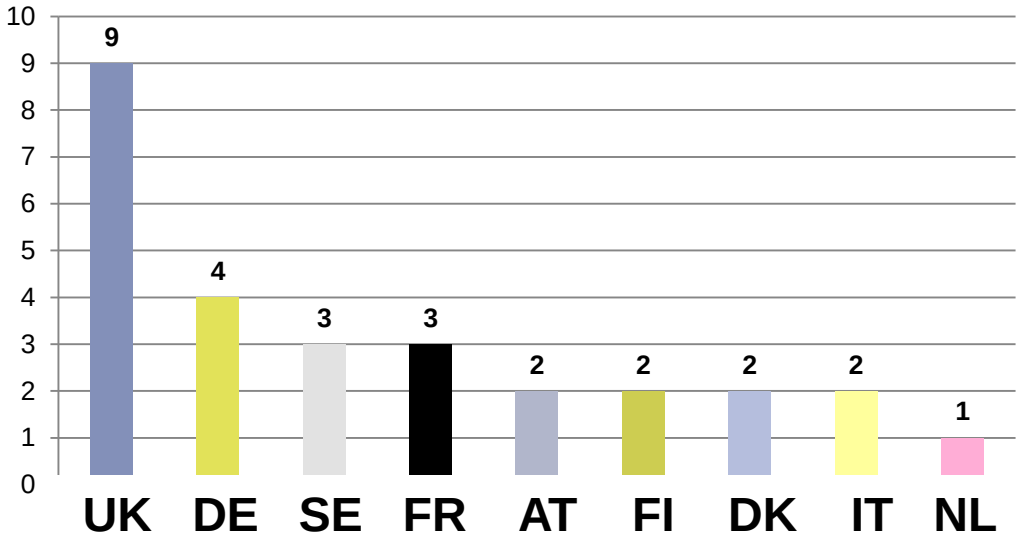
There are <u>three</u> primary sectors for resource exchange:

- ✓ 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



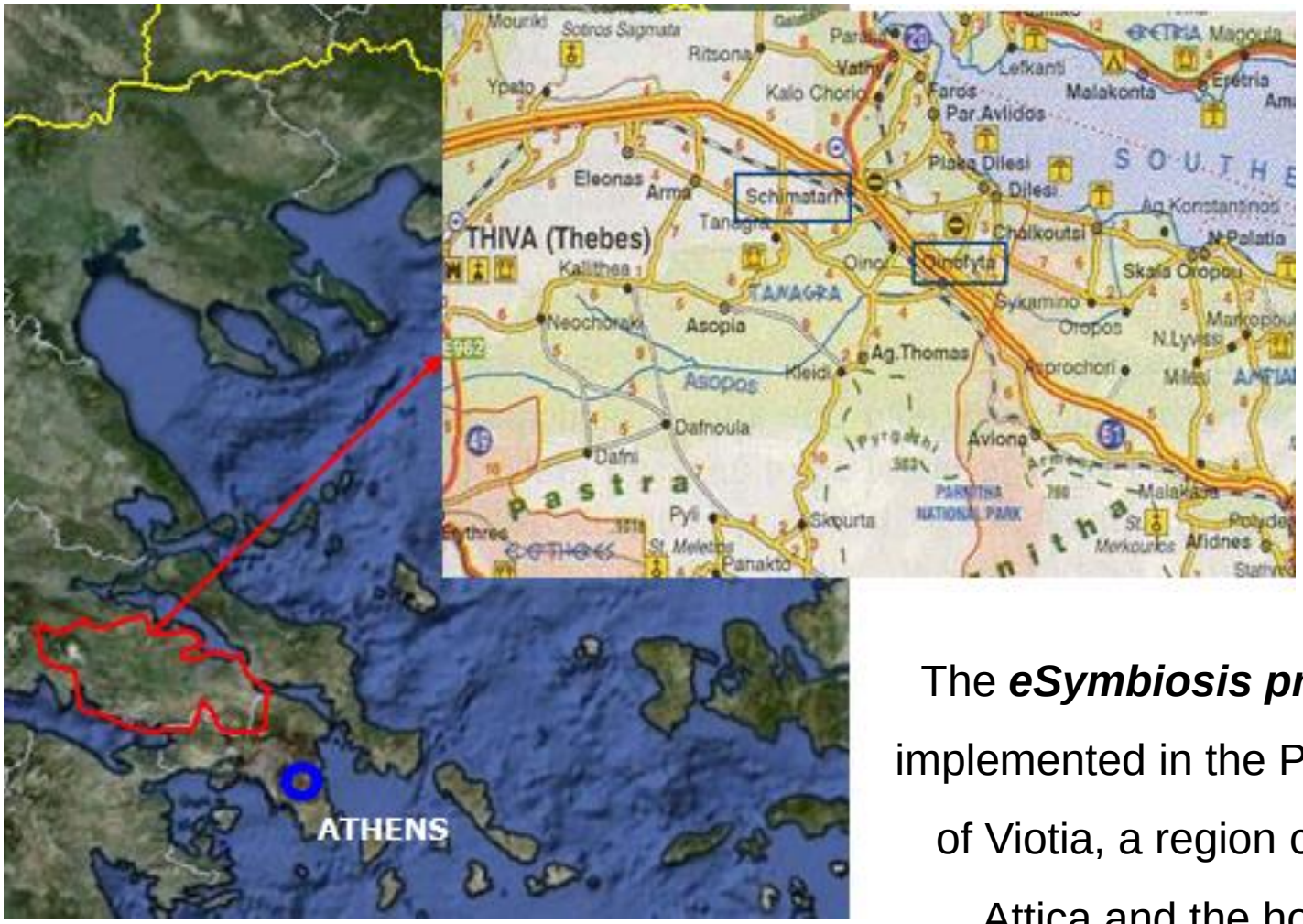
The eSymbiosis project

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.

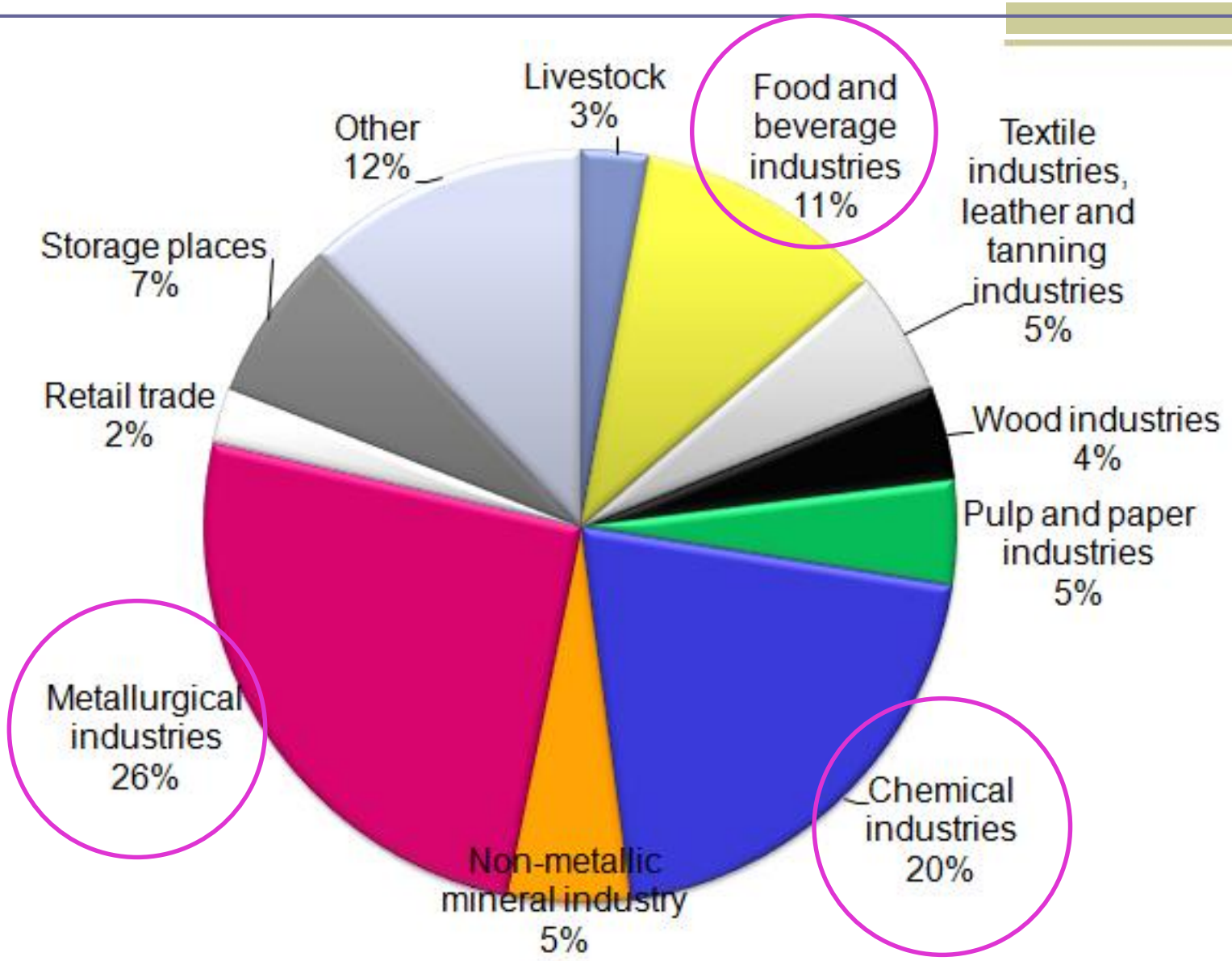
http://www.esymbiosis.gr/

The eSymbiosis project



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

Profile of the study area



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

eSymbiosis

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*

EoW criteria

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"*

EoW criteria

Accomplished Technical studies and Adopted Regulations on EoW criteria

	Waste Stream	Technical Study EoW	Regulation
1	***Category I.1***: Iron and Steel Scrap	«End-of-waste Criteria for Iron and Steel Scrap: Technical Proposals» (2010)	***EoW Regulation (333/2011)***
2	***Category I.1***: Aluminium and Aluminium Alloy Scrap	«End-of-waste Criteria for Aluminium and Aluminium Alloy Scrap: Technical Proposals» (2010)	
3	***Category I.1***: Copper and Copper Alloy Scrap	«End-of-waste Criteria for Copper and Copper Alloy Scrap: Technical Proposals» (2011)	Commission Regulation on EoW for copper scrap (715/2013)
4	***Category I.1***: Paper	«End-of-waste Criteria for Waste Paper: Technical Proposals» (2011)	*Expected Regulation*
5	***Category I.1***: Glass	«End-of-waste Criteria for Glass Cullet: Technical Proposals» (2011)	***Commission Regulation on EoW for glass cullet (1179/2012)***
6	***Category I.2:*** *Biodegradable waste compost/ digestate*	«End-of-waste Criteria for Biodegradable waste (compost/digestate): Technical Proposals» (2014)	*Expected Regulation*

Waste from Metallurgic companies

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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http://uest.gr/