SCALing European Resources with industrial symbiosis

Cliona Howie | 06-06-2019 | Helsinki, Finland

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The European *process industry* is one of the main pillars of Europe’s economy.

But as of today, this industry is *energy and resource intensive*, with significant *carbon emissions* and a high dependence on *resource availability*. 
SCALER Overview

**Deliverable Partners**
- iSQ
- University of Cambridge
- Strane Innovation
- Quantis
- Cimatik-KIC

**Priority Areas**
- Industrial Symbiosis
- Process industry

**Key Areas**
1. **Policy & Standards**
   - Addressing the policy and standardisation gap for IS
2. **Technology**
   - Identifying key enabling technologies for IS
3. **Circularity Gap**
   - Estimating the potential of IS in Europe
4. **Impact Assessments**
   - Assessing the impact of IS on environment and society

**Offer**

**Policy Recommendations**
- Policy and standard recommendations for the Commission

**Stakeholder Engagement**
- Convening industry and government

**Innovation Camp**
- Brussels event supported by EC to catalyse knowledge and technology transfer on IS

**Workshops**
- 5 EU regional workshops for IS capacity building
A systemic approach is needed to address this – not only by implementing circular systems at factory level, but at industry level. Manufacturing processes need to be considered as part of a larger picture.
Research on state of the art
25 case studies

Among which...

- Relvão Eco Industrial Park, Municipality of Chamusca, Portugal
- Kalundborg, Denmark
- Kawasaki Eco-town, Japan
- Industrial park in Ulsan, South Korea
- Lidköping, Sweden
- The West Midlands Industrial Symbiosis Programme (WISP), West Midlands, UK
- Nanning Sugar Co., Ltd., China
- The Kwinana Industrial Area, Western Australia
- The West Midlands Symbiosis Programme (WISP), West Midlands, UK
What did we look at?

- Incentives
- Enablers
- Intermediaries
- Benefits
- Stakeholders
- Challenges
- Tools & Technologies
- Relationships
- Triggers
- Decision Making
- Barriers
What did we look at?

Read the results

https://www.scalerproject.eu/resources/reports
Mapping of industrial facilities in Europe
Map (Partial – limited to 2 000 sites)
### List of industrial sectors

#### Priority 1:
- **Steel**
  - Sinter Plants
  - Pelletisation Plants
  - Coke Oven Plants
  - Blast Furnaces
  - Basic Oxygen Steelmaking and Casting
  - Electric Arc Furnace Steelmaking and Casting
- **Cement**
  - Dry Process
- **Ceramics**
  - Brick and roof tiles
  - Wall and floor tiles
  - Table and ornamental ware
  - Sanitary ware, refractories
  - Technical ceramics
  - Clay pipes
  - Expanded clay
  - Refractory products
  - Porcelain enamel
- **Chemicals**
  - Oil refineries
  - Organic chemicals
  - Inorganic chemicals

#### Non-ferrous metals
- Copper
- Aluminium
- Lead and tin
- Zinc and cadmium
- Precious metals
- Nickel and cobalt
- Carbon and graphite electrodes cathodes and shapes

#### Minerals
- Calcium carbonate
- Bentonite
- Lime
- Silica
- Feldspar
- Talk
- Kaolin

#### Priority 2
- **Energy**
  - Gasification and liquefaction
- **Waste management**
  - Hazardous wastes
  - Non-hazardous wastes
  - Incineration
  - Landfill
  - Animal carcasses
- **Glass**
- **Fertilisers**
- **Food and beverage**
  - Slaughterhouses
  - Animal products
  - Vegetal products
  - Milk

#### Priority 3
- **Mineral fibres and asbestos**
- **Pharmaceuticals**
- **Explosives**
- **Biocides**
- **Intensive livestock production and aquaculture**
- **Textile**
  - Pre-treatment
  - Tanning
- **Surface treatment of metals and plastics**
- **Carbon or electro-graphite production**
- **Ships building, painting**

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**Covered by Strane’Methodology based on BREFs analysis**

**Covered by SCALER D2.1**

**Out of scope due to a lack of bibliographic resources**
Flows & Synergies: Identification, Characterisation & Assessment
Systemic approach

QUANTITATIVE COLLECTED DATA

- Sector annual flow rate
- Number of facilities
- Process annual flow rate
- Number of processes
- Inputs flow rate
- Outputs flow rate
- Flows state of matter
- Flow composition
- Resource composition
- Process temperature
- Flow characteristics: pH, LVH, temperature, conductivity
Results

List of 100 varied and promising synergies
Full list of synergies identified

<table>
<thead>
<tr>
<th>VALIDATION SOURCE</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCALER METHODOLOGY</td>
<td>90 / 100</td>
</tr>
<tr>
<td>BEST PRACTICES</td>
<td>29 / 100</td>
</tr>
<tr>
<td>BREF</td>
<td>45 / 100</td>
</tr>
<tr>
<td>INDUSTRIAL PARTNERS</td>
<td>2 / 100</td>
</tr>
<tr>
<td>SUM OF VALIDATION FROM OTHER SOURCES</td>
<td>61 / 100</td>
</tr>
</tbody>
</table>

Representative sample ?  ➔ On 17 sectors; Mixing existing synergies and new synergies opportunities ; A lot of current practices

Relevant synergies ?  ➔ Validation methodology + ISQ confirmation for indirect ones !
Results

Sender sectors

Receiver sectors

SCALING EUROPEAN RESOURCES WITH INDUSTRIAL SYMBIOSIS
Results

Status quo

Type of resource

Identification method

Type of synergy

SCALING EUROPEAN RESOURCES WITH INDUSTRIAL SYMBIOSIS
Results

Steam recovery and transfer opportunities

Heat recovery and transfer opportunities

Scaling European Resources with Industrial Symbiosis
Results

Waste recovery for fuel production by waste treatment industries

- Organic chemicals: 27.1%
- Steel: 29.1%
- Refining mineral oil and gas: 2.1%
- Waste incineration: 4.0%
- Production of pulp, paper, and board: 22.8%
- Slaughterhouses and animal by-products industries: 10.1%
- Food, drink, and milk industries: 35.7%
- Non-ferrous metals industries: 15.4%
- Cement: 7.7%
- Organic chemicals: 23.1%
- Combustion plant: 23.1%
- Steel: 19.4%

Scaling European Resources with Industrial Symbiosis
Technologies database
## Objective 1 - Categorization of identified synergy typologies structure.

### Table 6

<table>
<thead>
<tr>
<th>Energy ID Number</th>
<th>BY-PRODUCT</th>
<th>STATE OF MATTER</th>
<th>ELEMENT OF INTEREST</th>
<th>SENDER SECTOR AND PROCESS</th>
<th>RECEIVER SECTOR AND PROCESS</th>
<th>SYNERGY DESCRIPTION</th>
<th>TECHNICAL OBJECTIVE</th>
<th>RESOURCES EXCHANGED</th>
<th>TYPE OF SYNERGY</th>
<th>CONFIDENCE LEVEL</th>
<th>IDENTIFICATION SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>COKE OVEN GAS</td>
<td>GAS</td>
<td>METALLURGY</td>
<td>STEEL/IP COKE OVEN PLANTS</td>
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<td>The use of the syngas to recover coke oven gas from steel mills and steelworks to provide special steel products. There are 38 coke oven plants in Europe. They produce 9.084 TWh of coke from 1.822 TWh of coke. The annual CO2 volume is between 8.1.10^14 m³ and 10.10^14 m³. The steel industry produces 9.084 TWh of coke and 1.822 TWh of coke. The annual CO2 volume is between 8.1.10^14 m³ and 10.10^14 m³.</td>
<td>Physical hydrogen</td>
<td>MATERIAL EXCHANGE</td>
<td>INDIRECT</td>
<td>HIGH</td>
<td>SCALING METROLOGY BFP</td>
</tr>
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<td>COKE OVEN GAS</td>
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<td>EMISIONS</td>
<td>LIQUID METAL</td>
<td>MANUFACTURING</td>
<td>STEEL/IP FOUNDRY AND FORGING</td>
<td>METALLURGY</td>
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Exploiting SCALER tools

Circular Economy Activities & Services
Benefits

Costs savings

➔ Improve the performance
➔ Reduce supply costs
➔ Reduce wastes management costs
➔ Legal changes anticipation

New incomes

➔ Value creation from your wastes and under-used resources
➔ Sale of excess CO2 quotas
➔ Differentiating aspect on the market

Territorial anchoring

➔ Long-term partnership creation with local actors
➔ Securing your supplies
➔ Circular Economy brand perception

Environmental & social benefits

➔ Environmental footprint reduction
➔ News jobs creation
➔ Support for sustainable industrial policies
Offer

Which valuable stream?
- Identify **synergies**
  - Flows economic assessment
  - Synergies identification
- MFCA analysis & ideation workshops
- Models of 160 industrial processes from 18 sectors
- Matching algorithms & a list of 500 synergies

With whom to collaborate?
- Locate **partners**
  - Locate relevant sites
  - Contact and appointment
  - Selection of convinced partners
- +30 000 geolocated sites database in UE
- Stakeholder involvement methodology
- Value mapping collaborative methodology

What about the implementation?
- Help decision-making process
  - Required technologies identification
  - Technico-economic, social and environmental assessment
  - Business cases definition
- Technologies database for wastes and effluents treatment
- R&D in sustainable business models
- Environnemental and social Life Cycle Analysis
Get involved!

Visit our website
Find out more at www.scalerproject.eu and see how you can work with us.

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