Industrial symbiosis in Nordic regions

- Good practice cases, actors, instruments and potential for future growth

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Background for the study

- Secretariat for the Nordic Working Group on Green Growth – Innovation and Entrepreneurship in 2013-2016, set by the Nordic Council of Ministers

- *To what extent and how can IS be a driver for green growth in Nordic regions?*

- The aim:

  - To map i) the potential for growth in IS, and
  ii) IS-relevant policies in the different Nordic countries
  - To present in-depth regional case studies of IS

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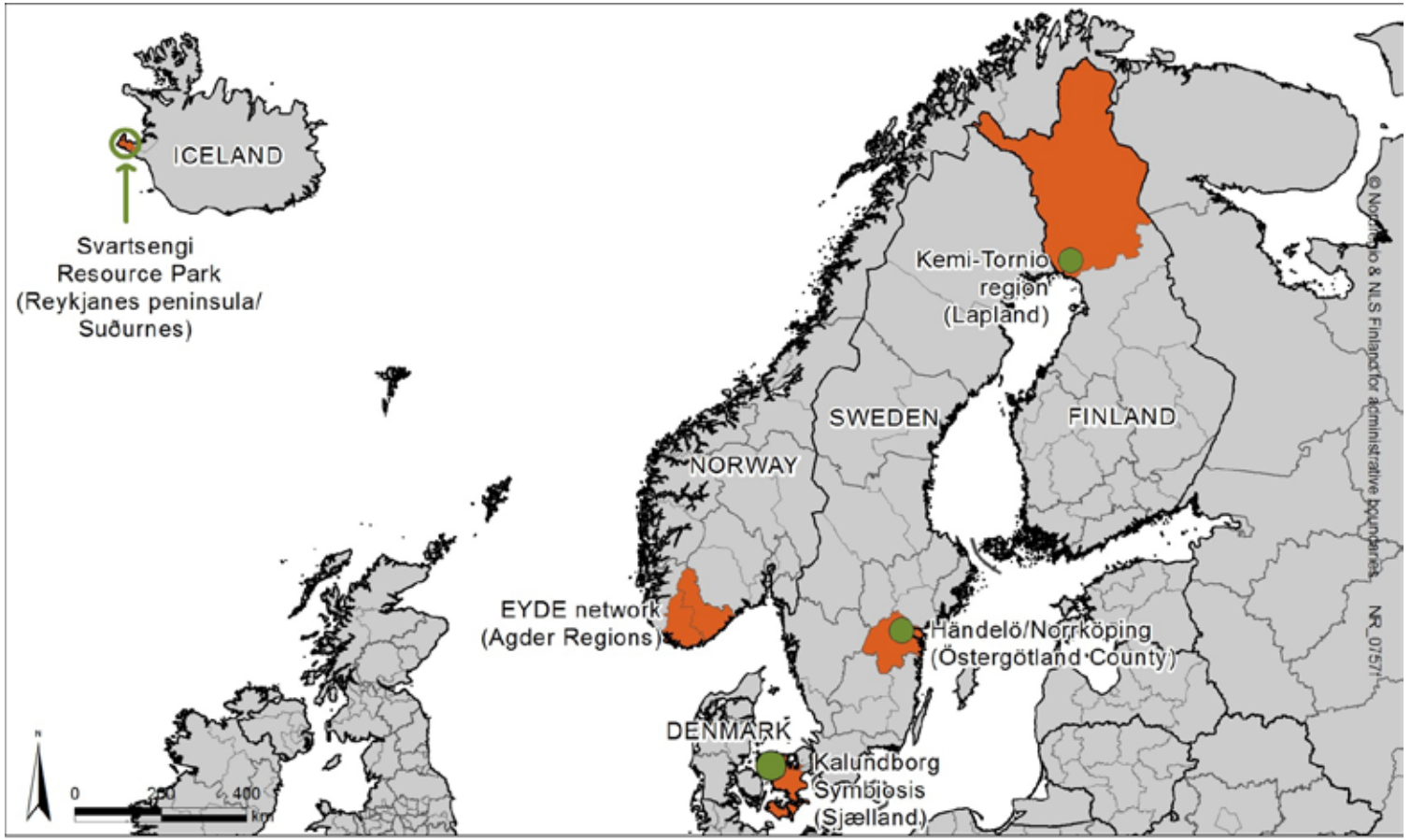
Case-study regions



Nordic industrial symbiosis case study regions

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National boundary

Regional boundary (NUTS 2)

Regional boundary (NUTS 3)

Case 1: Kemi-Tornio region, Lapland, FI

- Population 61,000
- Responsible for 80% of Lapland's industrial production, with over 5 billion EUR of exports annually (7-8 % of the total export value of Finland)
- IS estimated at 200 million EUR annually
- Established in 2001-2003

Main industry sites in Kemi-Tornio region

- **Metsä Board and Metsä Fibre Kemi mills**
  - linerboard production site & pulp mill
- **Outokumpu Chrome Kemi mine**
- **Outokumpu Tornio stainless steel mill & ferrochrome smelter**
- **Stora Enso Veitsiluoto Mill**
  - pulp mill, three paper machines, sawmill
- **Kaidi Biorefinery investment plan in Kemi**
- **Manga LNG terminal in Tornio 2018**

Kemi-Tornio IS characteristics

- Type of IS: By-product exchange an
  in earth filling, riffler waste as fuel,
  from the Outokumpu ferrochrome
- 2014 Inventory of regional industria
  private initiative; 1, 4 million tonne
- Regional strategies and support ins
  - ERDF programme for Lapland 2
    a new regional plan for climate
  - Lapland's Arctic Specialisation
    utilization of natural resources

Stream	Quantity t/a
Ferro-Chrome Slag	650 000
Steel Slag	400 000
Calcite + Filter Dust	60 000
Burnt Lime/Slaked Lime	30 000
Fiber Clay	20 000
Water Purification Precipitate (Steel)	20 000
Dolomite- Bricks	20 000
Clacite	15 000
Biosludge	12 000
Ferro-Chrome Underflow	10 000
Debarking Waste	9 000
Fly Ash	7 000

Kemi-Tornio: Classification of by-products (Poikela 2016)

DIGIPOLIS

Fractions are categorized according suitable properties for the different uses:

Classification	Examples of utilization
Supporting materials	Agriculture and road construction, concrete aggregate, mining areas
Bases	pH control, liming and soil amendments
Organic matter	Landscaping, combustion
Ashes	Agriculture and road construction, soil amendments, mine filling
Packing materials	Sealing layers of landfill sites
Symbiotic products	Multiple uses

- Single stream can belong to multiple categories
- Suitability is examined on general level
- Limiting factors - each streams has unique characteristics and compounds + producers own use
- On the basis of the analysis results → the process of piloting starts

Future development of IS in Kemi-Tornio

- Opportunities:
  - Industrial symbiosis activities are driven by business opportunities
  - Mapping of by-products side streams shows increased potential for the development of IS
  - Resource efficiency is on the political agenda and positive attitudes among decision makers
- Challenges:
  - Unraveling needs and ideas of companies regarding IS
  - The need to make a transition from managing companies' individual waste flows to creating and strengthening more holistic system for reuse of by-products (need for coordinator / cluster)

Case 2: Svartsengi Resource Park, Iceland ("Blue Lagoon")

- Geothermal sources - and the Blue Lagoon spa forming the Resource Park concept in 1989
- Goal: to "equally" pursue ecological balance, economic prosperity, and social progress
- 600 people employed, 50% of them by the Blue Lagoon

Svartsengi Resource Park characteristics

- Actors: HS Orka, Carbon Recycling International (CRI), ORF Genetics, Blue Lagoon bathing facility, treatment centre/health facilities, R&D centre

- Opportunities:

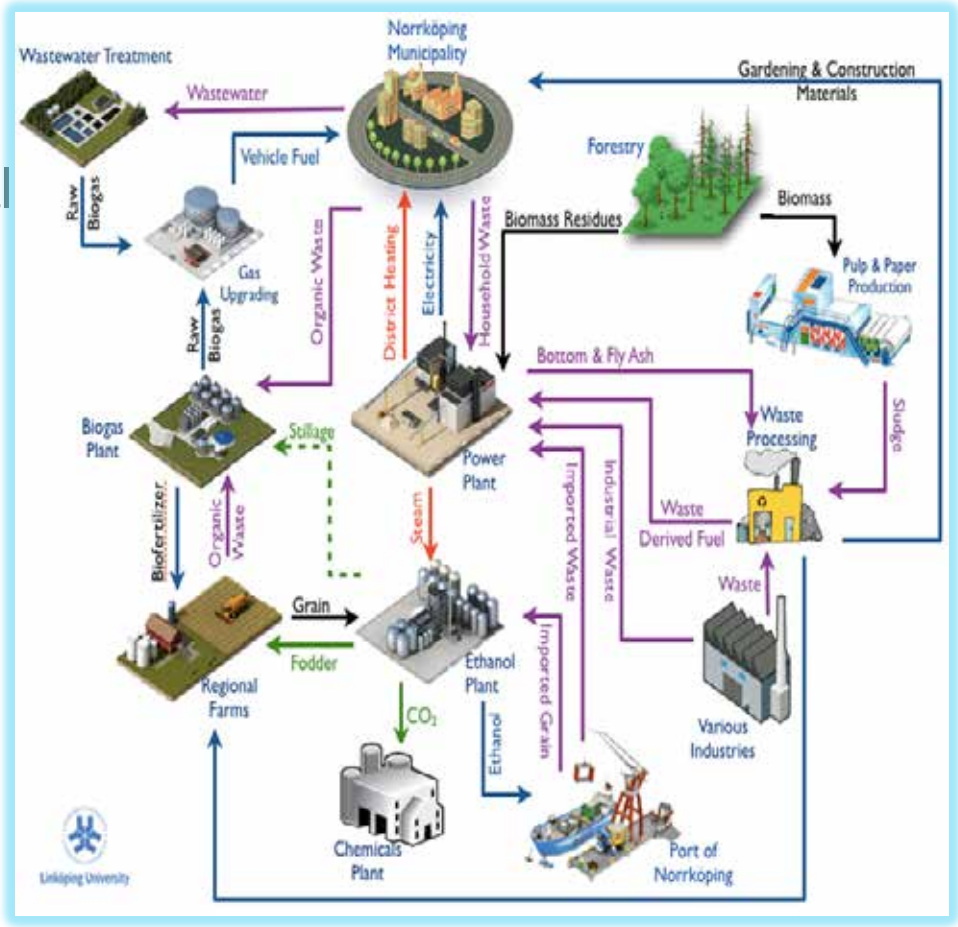
  - Commitment to the Resource Park philosophy and the visionary mind-set of the leadership
  - Strong culture of co-operation in Iceland and consensus on the regional development priorities
  - Diverse business activities and revenue steams result in diversified financial risks
  - Low energy prices and access to renewable energy

- Challenges:

  - Lack of national and local support schemes for CE/ IS activities
  - A failure to build consensus may potentially affect network functionality
  - Difficulty attracting investors

Case 3: Händelö IS, Sweden

- A private initiative with EON CHP plant, Agroetanol chemical factory, and Svensk Biogas as core companies -ca 2007
- Wide geographical boundaries
- Farms providing inputs to ethanol production / fodder and ferilizers in return



Händelö IS characteristics

- Opportunities:
  - Establishment of a platform for product development, finding new areas of co-operation, etc. appears to be a tremendous opportunity for development
  - Regional trust in cleantech, recycling and sustainable development
  - Local proximity to large firms in related industries

- Challenges:
  - Mobilizing the municipality and county in the development of the symbiosis, more focus is on new businesses
  - Sensitivity when it comes to the interaction around waste streams: a lack of input material; competing markets for residuals

Key findings

- For companies, business opportunities are the major driving force behind the development of IS
- Support by local and regional authorities (DK, FI)
- The use of European Structural and Investment Funds (ESF; ERDF)
- Cluster organizations play an important role as coordinator
- Future opportunities for new companies and jobs (for highly qualified) based on IS activities; new value chains, private consultancies in technical and green business fields

Key findings

- Hindrances: lack of time and resources of the companies to develop IS, lack of IS expertise in the regions, low awareness of the opportunities provided by IS

- The volume of regional/local Industrial Symbiosis activities difficult to obtain. Some figures available e.g. Kemi/Tornio 200 M Euros in 2015

- Differences in approaches to IS in the Nordic countries (e.g. Danish Business Authority- Green Symbiosis Programme)

Policy implications

- A long-term public support framework for Industrial Symbiosis with coherent objectives and strategies, based on the private sector needs and the actual demand of the industries
- Development companies and regional networks/clusters to facilitate and promote Industrial Symbiosis
- Local and regional can and should support and facilitate the development of industrial symbiosis
- The European Structural and Investment Funds provide good opportunities to apply for IS projects focused on resource efficiency and innovation
- Nordic co-operation e.g. in co-financing of demonstration plants; sharing of methodologies; dissemination of knowledge about the opportunities of IS; establishing an online platform of mapping the (waste/side stream) flows.

Takk!

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http://www.nordregio.se/industrialsymbiosis