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Industrial Symbiosis

A key driver of Green Growth in Nordic Regions?

Industrial symbiosis (IS) is all about saving money and reducing consumption by working together to maximise the outputs that can be generated from resources. It is one approach to realising a circular economy and achieving green growth. Through symbiotic activities between organisations, IS promotes sustainable resource use, minimises the input of materials and simultaneously eliminates waste. This policy brief presents five IS case studies from across the Nordic Region followed by a series of policy recommendations based on good practice in Nordic countries.

Industrial symbiosis has many benefits – both economic and environmental. Firstly, it provides opportunities for existing companies to increase their profitability and competitiveness by reducing the cost of resources. Secondly, it presents substantial benefit to the environment by reducing both demand for materials and waste. Thirdly, it supports regional development by paving the way for the emergence of new and innovative businesses which take advantage of otherwise un-used industrial flows. Given all this, it is perhaps no surprise that IS has been pitched as a key driver of green growth in the Nordic Region.

Key concepts

Green growth: Fostering economic growth and development while ensuring that natural assets are not depleted but continue to provide the resources and environmental services on which our wellbeing relies.

Circular economy (CE): A production and consumption system where the majority of products and resources used in production processes can be reused or recycled.

Industrial symbiosis (IS): A method of green growth in which companies exchange resources (e.g. by-products like hot water or bio-waste) for use as substitutes for commercial products or raw materials. It engages traditionally separate but geographically proximate firms in a collective approach providing benefits for both businesses and the environment.

NORDIC CASE STUDIES

Industrial symbiosis activities are already occurring to some degree in all of the Nordic countries. There is however substantial variation in each country's approach. In Finland and Denmark the activities are stimulated through a top-down approach. This approach includes a clear vision, comprehensive strategies at both the national and regional levels and active facilitation of IS exchanges by municipal and regional actors in partnership with key private companies. In contrast, initiatives in Iceland, Sweden and Norway are characterised by a bottom-up approach. In these countries, the concept of industrial symbiosis is largely absent from the policy agenda and IS development is instead driven by private companies and business parks.

Kalundborg

(Zealand Region, Denmark)

The Kalundborg industrial symbiosis has eight major private and public partners and involves approximately 50 symbiotic exchanges ranging from waste water treatment to supply of excess gas and novel use of fly ash. The collaboration dates back to 1961, though the term industrial symbiosis was only applied in 1989. Kalundborg has actively promoted activities in the region, establishing a "Symbiosis Centre" that aims to strengthen business development in Denmark and support the dissemination of knowledge about industrial symbiosis.

Opportunities, challenges and outcomes

Kalundborg currently results in CO₂ emission reductions of approximately 300,000 tonnes annually (Johnsen et al. 2015). Substantial opportunity for further growth is apparent; with ambitious public policy prioritising IS development at

the national, regional and local level and high regard for the national symbiosis program within the business community. The next big challenge on the horizon for Kalundborg is further development of concrete measures of IS impact – both economic and environmental.

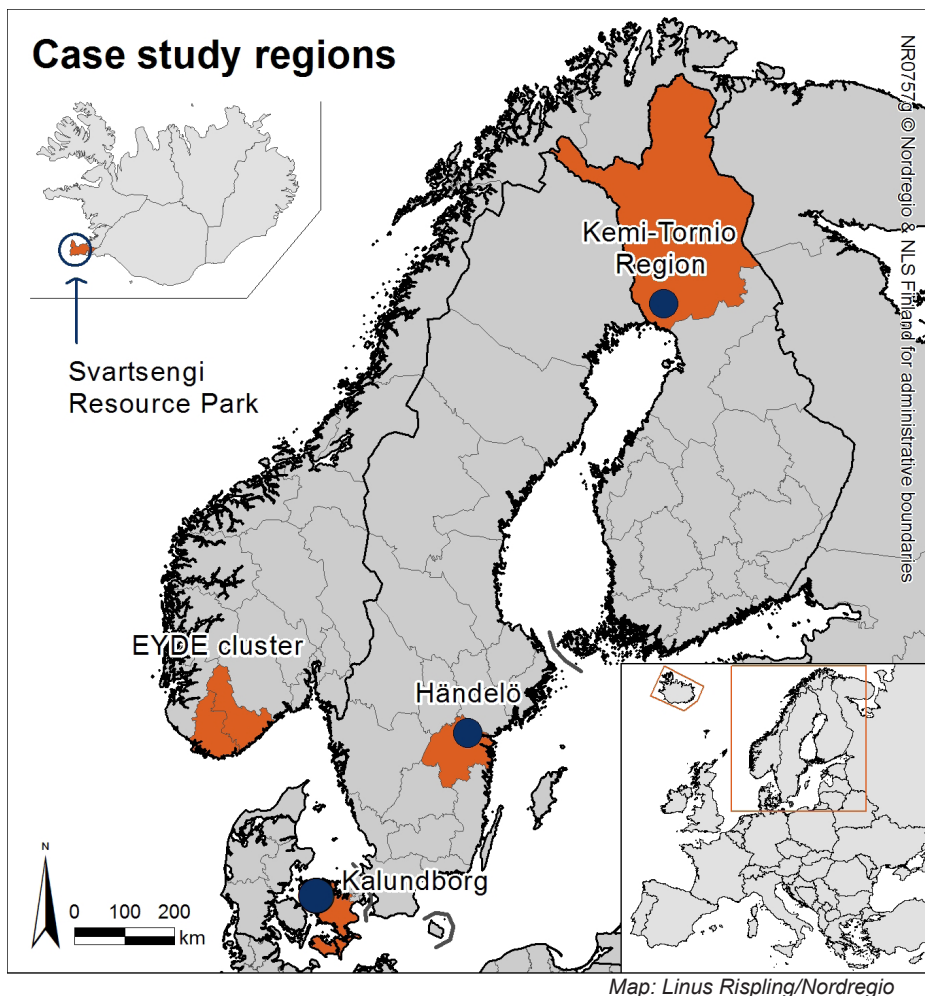
Kemi-Tornio Region *(Lapland, Finland)*

Key elements of the industrial symbiosis in the Kemi-Tornio region include forestry, mining and steel industry companies, industrial service companies, research and educational organisations and intermediaries. Digipolis, the Kemi Technology Park, has been an important player in promoting the IS in the region. The basic concepts have been present in the region for decades, but more systematic activities began in the early 2000s.

Opportunities, challenges and outcomes

The total volume of industrial symbiosis activities in the Kemi-Tornio Region has been estimated at 200 million EUR annually (Johnsen et al. 2015). Opportunities to build on this number are clearly evident, thanks to a 2014 mapping project that focused on revealing potential symbiosis and creating connections through which to facilitate exchanges. In addition, IS enjoys strong public support in the re-

gion due to the potential of sustainable natural resource use to support regional development by adding value to Lapland's exports. A long-term and systematic role for a competent and trustworthy intermediary to continue the work initiated though the mapping project will be key to building on the already promising work in the region.



Svartsengi Resource Park (Reykjanes Peninsula, Iceland)

Svartsengi Resource Park, or, as it is more commonly known, The Blue Lagoon Geothermal Spa, utilises geothermal resources from the HS Orka power plant in a diverse range of activities – from fish drying to dermatological research. Activities began in 1976 and the Resource Park philosophy was defined and instituted in 1988/89. Research and innovation play an important role in the partnership, with over four million USD

spent annually on interdisciplinary R&D.

Opportunities, challenges and outcomes

Svartsengi Resource Park is a unique example of an industrial symbiosis driven by a single private partner (HS Orka power plant). All participating businesses are entirely privately funded and are economically sustainable. The visionary leadership of HS Orka, along with the trust and understanding built up between

the actors within the Resource Park, have been crucial to its success. Although minimal public funding has been provided to Resource Park activities it is important to note that Grindavík municipality co-operates extensively with local industry to promote green growth more broadly. Further expansion is currently underway in the Resource Park and is expected to provide 550 new jobs in the region (450 in construction and 100 ongoing).

Eyde Cluster (Agder, Norway)

The 13 member companies of the Eyde Cluster are all involved in manufacturing, producing specialized products (metals, materials and chemicals) for the global market. The Cluster was established in 2007 and activities to date have been focused on laying the groundwork for future activities. Connections have been established between member companies and substantial R&D work has been undertaken. One of the most developed projects “Eyde Biocarbon” aims to find sustainable economic solutions to replace

petroleum coke and coal with locally sourced and produced biochar/biocoal that can be used in the production of silicon and silicon carbide.

Opportunities, challenges and outcomes

The Eyde Cluster member companies have a combined annual turnover of approximately 1.15 billion EUR and together employ over 3,000 people. As a result there is great potential for industrial symbiosis activities within the cluster to

contribute to future growth and provide jobs in the region. Despite this, concern remains with respect to the long-term prospects of activities. Though the cluster has had political and financial support at the regional level, it is heavily reliant on short-term funding and investments from the companies themselves. Stronger support for IS at the national level that is linked to long-term funding opportunities would provide greater certainty for the cluster during the development phase.

Händelö (Norrköping, Sweden)

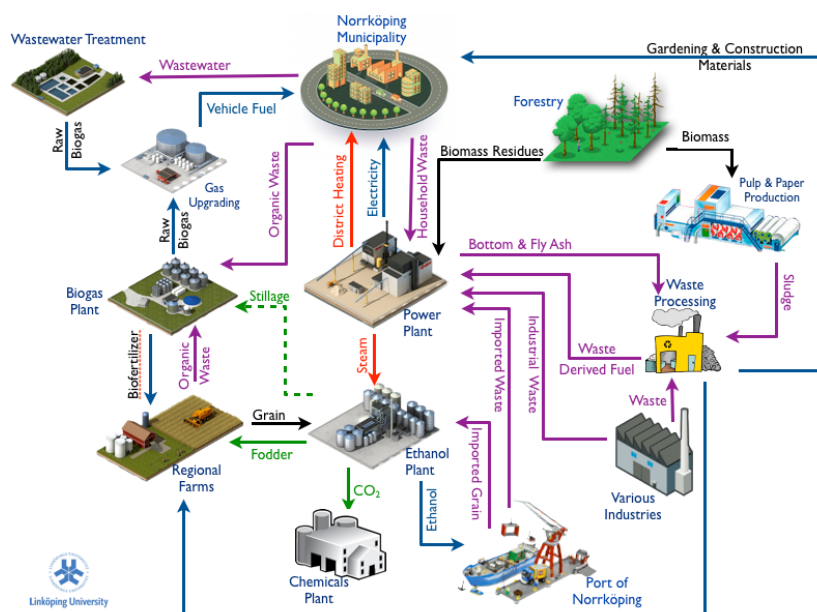
The Händelö industrial symbiosis involves many actors and is primarily focused on side-stream utilisation (see figure). The first steps towards IS in the region can be traced to the sale of the combined heat and power plant by the municipality in the early 1990s and development since then has occurred incrementally.

Opportunities, challenges and outcomes

There is substantial potential for industrial symbiosis to contribute to regional development in Händelö, including business opportunities relating to utilisation of waste streams and scope for R&D activities and demonstration facilities. At present, however, long-term commitment appears to be limited to managing “streams”, with insufficient interaction between the partners at a strategic level and little evidence of a joint commitment

to R&D. Similarly, municipal and regional actors, while supportive of IS from a policy perspective, have shown limited interest in utilising it as a regional development tool, or in branding Händelö as a

regional success story. Realising the full potential of Händelö will require a shift towards “systems solutions”, perhaps driven through support from public actors at the regional or national level.



Policy recommendations

Based on the five case studies, and the analysis of each national context, Nordregio makes the following recommendations designed to support further growth of industrial symbiosis across the Nordic Region.

- Develop a long-term public support framework for circular economy and industrial symbiosis activities, including comprehensive and coherent strategies and binding objectives.
- Provide greater support for industrial symbiosis activities through local and regional authorities. This may include promoting the development of networks/clusters based on local and regional strengths and helping to identify exchanges for which a good business case exists.
- Support the emergence of local and/or regional development companies, regional clusters or other organisations that facilitate and promote industrial symbiosis in Nordic regions.
- Focus on private sector needs and actual demand for relevant inputs in the industries involved. Long term economic gain is essential to the sustainability of industrial symbiosis activities as well as ensuring that such activities promote the emergence of new businesses and innovations.
- Use the European Structural and Investment Funds available to support industrial symbiosis activities in Nordic regions.
- Promote innovative approaches to industrial symbiosis development. For example, mapping of industrial side-streams (Kemi-Tornio region, Finland) and free resource checks for companies (Denmark).
- Explore the potential for use of financial incentives to encourage companies to engage in industrial symbiosis activities.
- Increase awareness and understanding of the industrial symbiosis concept across the Nordic countries.

Find out more

This policy brief by Nordregio was commissioned by the Nordic Working Group on Green Growth – Innovation and Entrepreneurship, a working group set by the Nordic Council of Ministers. The policy brief is based on this report:

Johnsen, I. H.G. (Ed.), Berlina, A., Lindberg, G., Mikkola, N., Smed Olsen, L. & Teräs, J. (2015). The potential of industrial symbiosis as a key driver of green growth in Nordic regions. Nordregio Report 2015:1. Nordregio, Stockholm.

Further reading

Teräs, J., Lindberg, G., Johnsen, I. H.G., Perjo, L. & Giacometti, A. (2014). Bioeconomy in the Nordic region: Regional case studies. Nordregio Working Paper 2014: 4. Nordregio, Stockholm.

Teräs, J. (2015). BIOECONOMY – the Growth Engine of Nordic Regions? Nordregio Policy Brief 2015: 5. Nordregio, Stockholm.

Forthcoming publications

Green Growth Handbook (Spring, 2016)

Green growth in Nordic regions: State of play, practices and needs (Spring, 2016)

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Nordregio conducts strategic research in the fields of planning and regional policy. We are active in research and dissemination and provide policy relevant knowledge, particularly with a Nordic and European comparative perspective.