

NORDIC COUNTRIES' PERSPECTIVES ON LOW-CARBON INDUSTRY TRANSITION

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Number of groups: One group

Group size: 3-4 students

Target programs: K, Kf, F, M

BACKGROUND

In the context of climate change mitigation, the European Union has set ambitious targets for greenhouse gas emission reductions (European Fit for 55 package). The Nordic countries signed a joint Declaration on Carbon Neutrality in 2019, committing to becoming carbon neutral in line with the COP21 Paris Climate Agreement. Scenarios to support this target have been developed, such as the Nordic Clean Energy Scenarios¹ of the Nordic Energy Research, a platform for co-operative energy research and policy development under the auspices of the Nordic Council of Ministers. In these scenarios, a core approach constitutes the transformation of industry and transport sectors that is characterized by clean electricity and decarbonised fuels.

At the same time, each country in the Nordics varies greatly in their industry setups, which influences the energy landscape or composition of the country in different ways. Sweden, for example, has a rather diversified industry predominating with pulp and paper, automotive, and steel. Norway's industry landscape, on the other hand, is primarily focused on oil and gas and ship building, while Denmark is known for its vast wind farms and light industries like pharmaceuticals. As a result, the energy composition and landscape differ remarkably in these countries. In addition, new industries can be created while incumbent industries may be phased out. As each industry requires different sets of raw materials and embodies a different value chain, it is crucial to understand how industry structures influence the future changes in the increasingly electrified energy landscape of these countries.

PROJECT GOALS

The project aims to investigate the relationship between industry structures and low-carbon energy transition in Nordic countries. Decarbonisation of industries raises several important systems questions such as:

- Which are the main energy consuming industries in the Nordic countries now and in the future? (How will the scaling of new industries, e.g., battery manufacturing, and displacement of existing industries affect electricity demand?)
- What is the energy mix of the industries and their potential for electrification?
- What is their raw material consumption and production pattern?
- What part of the supply chain of major industries occurs domestically and what part occurs internationally? How could that affect the future energy landscape?

¹ Wråke, M. et al. (2021). NORDIC CLEAN ENERGY SCENARIOS: Solution for Carbon Neutrality. *Nordic Energy Research*. <https://doi.org/10.6027/NER2021-01>

METHODOLOGY

A literature survey of main industrial structures in the Nordic region can be conducted to identify key industry setups that are energy and carbon intensive. The focus is on primary industries and energy systems, especially the ones with high potential to be electrified. As energy is an international business, both national systems and international transmission within the region can be considered. Depending on the number of students the regional scope can be adjusted.

Analytical frameworks like input-output analysis or material and energy flow analysis are then performed to study the impact of the supply chain of these industries on the energy systems. The results of such analysis can be used to shape up different future scenarios of electrification in the Nordic region.

DIVISION OF ENERGY TECHNOLOGY

The Division of Energy Technology conducts research and offers educational training in the areas of energy technology and energy systems. Ongoing projects and activities cover a broad spectrum of issues related to improving efficiency and reducing the environmental impact of energy conversion and usage in a wide range of sectors.

Our research aims at identifying resource-efficient and competitive technologies and transformation pathways that will enable the energy, energy-intensive heavy industry and transportation sectors to comply with ambitious international sustainable development goals. An important characteristic of our research is the combination of system level activities with in-depth development of energy conversion processes, as well as participation in many national and international research projects.

The work will be co-supervised by Nhu Anh Phan and Georgia Savvidou at the Division of Energy Technology. The examiner is Lisa Göransson. For more information about the Division of Energy Technology visit our website: https://www.chalmers.se/en/departments/see/research/energy_technology/Pages/default.aspx

Also, please note that this report can be written in Swedish, and if anyone from TKTFY is in the group the report must be written in Swedish.

OBS: Rapporten kan skrivas på svenska och om någon från TKTFY är med i gruppen så skall rapporten skrivas på svenska.

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