

Nordic biofuels

Analysing the path dependencies of Nordic biofuel technologies is a challenging endeavour. However, some clear path dependencies are revealed by the results of statistical and policy analyses, as well as through a number of case studies on second generation biofuels in Denmark, Finland, Norway and Sweden conducted for the TOP-NEST project.

The deployment of second generation biofuel technologies is influenced by first generation biofuels, competing energy systems, access to bioresources which different sectors compete for, competing niches of sustainable transportation and political steering.

First generation biofuels

It is important to pay attention to the simultaneous development of both first and second generation technologies. Conditions which are important for the emergence of first generation biofuels may affect the development of later generations. As long as second generation biofuels are used in low blends with fossil fuels, no expensive infrastructure changes are needed. If second generation biofuels were to replace fossil fuels completely, combustion engines would have to be adapted, thus leading to competition between low blends and the pure biofuels.

Competing energy systems

Energy production in the Nordic countries is based on different mixes of energy sources, produced and distributed via huge infrastructures. Bioenergy is traditionally used for heating and, to a lesser extent, for transportation. In 2011, the share of renewable sources in electricity generation varied from 98% for Norway, 59% for Sweden, 39% for Denmark and 28% for Finland (Eurostat).

Norway produced most of its electricity through hydropower. Sweden and Finland generated much of their electricity through nuclear power, while Denmark still had a considerable share based on combined heat and power generation fuelled by coal.

Access to bioresources

A relationship between resource endowment and path dependencies can be observed: in 2011, the production of renewable energy from wood and wood wastes in Sweden and Finland was more than 300,000 Terajoules for each country, while Denmark and Norway produced far less than 100,000 Terajoules from such resources (Eurostat).

Sweden and Finland have long used their forest resources for bioenergy production, especially in incineration, and over the last decade they have developed competencies in using forestry biomass for biofuel production. Denmark has less access to forest resources, but its intensive agricultural sector has residual outputs which can be disposed of via bioethanol production.

The paradox, however, is that while Norway also has wood-based bioenergy resources and a solid forestry and pulp and paper industry, just like Finland and Sweden, these resources have not been exploited sufficiently for energy generation. Yet, Norway also has to handle residuals from forestry, and there have been some attempts to produce bioethanol and biodiesel based on these resources in the last decade.

Biogas

The national situations also differ when it comes to the use of biogas: while abundant municipal waste and a ban on landfill were important for the development of biogas technology, especially in Sweden, where biogas is used as a fuel for vehicles, in Finland and Denmark biogas is mostly used for heating and electricity production.

In Norway, biogas has only been used in the last decade, and biogas for electricity production has economic drawbacks due to the available alternative of hydropower, although the upgrading of biogas to a vehicle fuel has recently become more appropriate in Norway.

Competing niches for sustainable transportation

Biofuels have to compete with electric mobility technologies for resources and attention. Biofuels are favoured by the Swedish automobile industry and a number of personal vehicles and trucks have been developed to run on biofuels, and the related infrastructure has been rolled out in Sweden. However, in Norway, no automobile industry has a primary interest in any specific biofuel, but, instead, electricity from renewable sources gives excellent conditions for experimenting on a large scale with electric mobility solutions.

Political steering

Policy makers face different challenges in the Nordic countries, based partly on their traditional industries and available energy resources. Policies aimed at stimulating industrial development allow for the creation of new SMEs and for existing industries to branch out into biofuels.

There is a potential for the Nordic countries to learn from each other, with one example of this being the public funding of demonstration projects.

Dr. phil. Antje Klitkou
TOP-NEST Project
NIFU Nordic Institute for Studies in Innovation,
Research and Education

email antje.klitkou@nifu.no
browse www.topnest.no