

Energy and Transport

Key results and recommendations





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Filip Ehrle Elveling (Editor)

*Hans-Olof Dahlberg, Hans Fridberg, Lars Hasselager-Olsen, Ágústa Loftsdóttir,
Lars Nilsson, Mogens Schrøder Bech, Erlend Solem, Per-Andre Torper and
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ISBN 978-92-893-2792-3

ISBN 978-92-893-2793-0 (EPUB)

<http://dx.doi.org/10.6027/TN2014-537>

TemaNord 2014:537

ISSN 0908-6692

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Layout: Hanne Lebech

Cover photo: Signelements

Print: Rosendahls-Schultz Grafisk

Copies: 200

Printed in Denmark



This publication has been published with financial support by the Nordic Council of Ministers. However, the contents of this publication do not necessarily reflect the views, policies or recommendations of the Nordic Council of Ministers.

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1. Nordic energy and transport cooperation



1.1 Introduction

The idea of a joint programme focusing on energy and transport within the Nordic region was first formulated at the Globalisation Forum on Iceland 25th–26th February 2009.¹ The programme was later launched under the umbrella of the Globalisation Initiative in June 2009 by the

¹ See www.norden.org/en/nordic-council-of-ministers/globalisation-co-operation/globalisation-forum/nordic-globalisation-forum-2009-the-blue-lagoon/rapport-fraan-globaliseringsforum-2009-island p. 7

Nordic Prime Ministers.² The Globalisation Initiative, spanning a wide array of topics, attempts to steer Nordic cooperation in a new direction to answer global challenges, such as environmental protection, energy policy and climate change mitigation.

The Energy and Transport programme is a Nordic initiative for carbon dioxide reductions, increase of energy efficiency and energy systems integration of the transportation sector in the Nordic region. A foresight analysis, focusing on Nordic strategies for renewable transport – commissioned by the Icelandic chairmanship of 2009³ – also helped to conceptualise the framework and foundation for the Energy and Transport programme. An overall need to utilise a stronger Nordic cooperation within the area, in order to create a competitive advantage for future climate change mitigation actions was identified. The programme was established to develop the Nordic region into a testing ground for sustainable transport solutions, develop common technical standards and narrow the gap between research and policy, and as such make the Nordic region the “Green Valley of Europe”.⁴

The transport sector will face fundamental changes in the future due to the need for highly efficient transports in a climate neutral way. This transformation will include strong challenges, but also opportunities for new businesses and technology improvements.

The Nordic countries have differences in their energy systems and in their knowhow. Differences that can strengthen the individual country in the strive for a sustainable transport system if more of the developments are done in a pan-Nordic context.

The programme focuses on two of the central issues in a strategy for an energy efficient and sustainable transport system; electric transportation and sustainable freight transportation, and covers both technical and societal aspects. The programme provides a comprehensive picture of the challenges and solutions available within the energy and transportation sector in the Nordic countries in order to further enhance cooperation on issues and themes where the most added value will be achieved.

² See www.norden.org/en/publications/publikationer/2009-789/at_download/publicationfile p. 2

³ The report can be found at www.nordicenergy.org/wp-content/uploads/2012/02/Foresight-Analysis-Nordic-Strategies-for-Renewable-Transport.pdf

⁴ <http://www.norden.org/en/news-and-events/news/danish-pm-nordic-countries-the-green-valley-of-europe>

1.2 Objective and strategy

The overall objective of the Energy and Transport programme is to contribute to making the Nordic region a leading region in Europe for developing, demonstrating and using new, sustainable energy technologies. This vision stems from the Globalisation Forum in 2009 on Iceland, and has since set the pathway for the programme. The transportation sector was specifically identified as an important area to address in order to achieve the vision. The Energy and Transport programme was designed to act as a platform for increased cooperation regarding the use of new sustainable energy technology solutions in the transportation sector. Thus, the programme will create a process that further develops the Nordic region towards this vision.

The strategic choice of launching the programme can be derived from the long, positive experiences of cooperation within the Nordic region, where common policies and common solutions can help meet Nordic and global challenges. A more sustainable direction of the transportation sector is seen as an area where Nordic cooperation is logical, necessary and possible. By creating a joint Nordic programme, the risk of duplicating, fragmenting and overlapping research can be reduced. Common measures can help create synergies within Nordic projects and policy areas. This will in turn strengthen the Nordic region further as a pioneer within international cooperation on new climate-friendly energy technologies and help profile the *Nordic way* globally. In addition, the programme has had a political goal to identify areas where Nordic cooperation can provide added value, and to formulate clear policy recommendations based upon the results from the projects.

Concrete goals were formulated during the course of the programme, where the most important ones were to:

- Collect a comprehensive picture of the Nordic region's strengths and priorities within the area to suggest Nordic cooperation possibilities.
- Gather information on existing technologies and fuels and assess what solutions are deemed most realistic to follow up on in the short and medium term.
- Establish a network within sustainable transportation in the Nordic countries.
- Develop regulatory and framework conditions for business opportunities within climate-friendly transportation and energy technologies.

- Identify areas for further Nordic cooperation within the transportation sector.
- Focus on international cooperation and on the value of appropriately disseminate the programme's results on a political level.

The main activity within the programme, in order to realise the goals set out, is to fund Nordic cross-border projects that will cover the aspects from the objective and strategy. The first call for projects had a thematic approach of electric transportation (in 2010), while the thematic of the second call was sustainable freight transportation (in 2011).

To achieve the first set of goals of collecting a comprehensive picture of Nordic strengths and priorities of energy and transport related policies, the Energy and Transport programme first initiated a mapping of such initiatives in the Nordic countries. This was done in order to create a clearer view of gap areas within the field. This mapping provides a snapshot of the policy initiatives and regulations of the current state of play. This set the foundation towards the two calls, guided their thematic approach and helped delimitating the project focus in order to create the most added value possible. A complete overview of the mapping can be found at www.energyandtransport-efforts.net

Since the Energy and Transport programme covers a broad spectrum of technology areas and solutions, the delimitation of two differentiated calls was made to brand each call with a specific portfolio. This helped create the necessary framework for the project applications whilst focusing on project themes of:

- Technical aspects.
- Regulatory framework conditions.
- Business development.

Further delimitations were conveyed as the Energy and Transport programme should include both personal and freight transportation (neither excluding fishing fleet nor commercial inland seaway traffic), but not air traffic, international shipping or infrastructure projects for railways.

The projects were also selected in a way that helps to establish new pan-Nordic relationships. By making efforts to have actors from the different countries meet and work together were new possibilities for a Nordic dimension in the future innovation process was created.

The Nordic energy system is diverse, meaning that the different countries have different distinguished areas of competence. Given the differences, as well as the similarities, the Nordic countries have an excellent opportunity to gain benefits from cooperation. This holds true especially in the field of energy and transportation, where the synergies are more prevalent than in other areas.

2. Funded projects

2.1 Electric Transportation Portfolio

The overall objective of the call for proposals in the Electric Transportation Portfolio was to identify and fund projects that contribute to the Nordic region strengthening its position in the development, testing and use of electric transport solutions. The projects funded through the call should increase the level of Nordic cooperation in the area of electric transportation – in creating new consortia, solving common Nordic problems or testing and implementing new technology and solutions. Funded projects should foster cooperation between different actors such as researchers, industry, NGOs and public organisations. The projects should further increase the knowledge base in the Nordic region on electric transport solutions and give recommendations to Nordic decision makers on how to strengthen cooperation in the field, and how to reach the Energy and Transport programme's overall objective.

The projects should consist of a consortium with representatives from at least three Nordic countries:

- *Call opening:* 1st September 2010.
- *Indicative project start:* December 2010.
- *Number of project applications:* 28.
- *Total amount of funds applied for:* 38.5 million NOK.
- *Number of funded projects:* 6 (7).⁵
- *Amount of funding from the Energy and Transport programme:* 9.8 million NOK.
- *Total budget of funded projects:* 18.2 million NOK.

The results from the six Electric Transportation Portfolio projects are presented below.

⁵ One project did not succeed in meeting its objectives due to unsuccessful testing procedures and partner withdrawal, and had to cancel its activities midway.

2.1.1 Range & Performance of Electric Vehicles in Nordic Driving Conditions

About the project

The RekkEVIDde project has collected data on Nordic driving conditions by performing laboratory and field tests at cold temperatures. Scientific measurements and analysis were made in order to develop a simple method to measure range and compare different electric vehicles in Nordic conditions.

Electric Transportation Portfolio

Range & Performance of Electric Vehicles in Nordic Driving Conditions

RekkEVIDde

Project partners
VTT Technical Research Centre of Finland (FI), Green Net Finland (FI), Test Site Sweden (SE), City of Stockholm (SE), Institute of Transport Economics (NO) and Icelandic New Energy (IS).

Policy conclusions
The project propose the introduction of an energy label for electric vehicles. A draft of a label has been developed after consultation with different stakeholders that includes information to consumers on range of car under different conditions, such as cabin temperature, cabin pre-heating, charge mode and temperature limit, as well as energy per km, average cost of usage and comparison to a standardised norm car model.

The objective

The main objective is to produce realistic performance indicators for electric vehicles operating in Nordic driving and weather conditions. This may help the industry to reduce the number of necessary test activities and to build suitable electric vehicles for the Nordic region, as well as provide more accurate consumer information.

The results

The test drive cycle data and information on Nordic driving patterns and conditions collected by the project shows that without cabin heating the total range is on average reduced by 27% in -20 °C compared to +23 °C. With electric cabin heating activated, the total range reduction can be up to 76% under the same conditions. However, the NEDC (New European Driving Cycle) laboratory tests show that the Nissan Leaf's drop in range to just 58 km in -20 °C conditions could be avoided. Simply by equipping electric vehicles (EVs) with a fuel-fired cabin heater, the range can be increased to 98 km.

Studies show that a typical driving distance in a day is less than 50 km divided into more than 3 trips. Therefore, it is obvious that electrical heating can be used for most trips, whereas the fuel heater can function as a range extender in colder Nordic conditions. The project has recognised the policy need for an EV energy labelling that shows the use of energy per km, the range and the average cost of annual use. This labelling should also compare vehicle performance to the electric vehicle models available on the market at different temperatures. For the future, field test procedures for simple and advanced testing of EV range should be performed through laboratory UN-ECE regulation No. 101 tests in cold conditions. The influence of EV cabin heating to the range with new heat pump EV models also needs to be tested further.

Electric vehicles are, due to the large share of renewable energy supply in the Nordic countries, expected to become an increasingly competitive and environmentally friendly option. Some manufacturers already provide cars suitable for the harsh Nordic climate, but the range limitations related to local temperature conditions is an issue that should be worked with further to tailor cars better to Nordic driving conditions.

2.1.2 *Scandinavian Analysis of Urban Freight Logistics Using Electric Vehicles*

About the project

There is a growing need for freight goods distribution in dense city centres. Freight carriers strive to provide optimal transportation services, but the current distribution systems are straining city logistics. The SAFE project therefore identifies four future scenarios for larger cities with associated new technological solutions and business models for these scenarios to provide for a better framework in the future.



Electric Transportation Portfolio

SAFE

Project partners
Insero E-Mobility (DK), ECOMove (DK), EC Tunes (DK), City of Stockholm (SE), Grønn Bil (NO), Post Danmark (DK), Arla Foods (DK) and Aarhus University (DK).

Policy conclusions
The project stresses that municipalities need to take a stronger role in promoting sustainable transport solutions, e.g. allow easy and fast access for EVs to and within cities, outsource part of public transport to electrical vehicle systems or similar, and support better opportunities for marketing of climate-friendly transported goods (e.g. the Nordic Ecolabel).

Scandinavian Analysis of Urban Freight Logistics using Electric Vehicles

The infographic features a stylized graphic at the bottom consisting of blue circles connected by lines, with green dashed lines extending from the bottom left towards the center, and a grid of yellow dots in the background.

The objective

The project objective is to facilitate the use of electric vehicles in city logistics, and thereby get city planners and industry stakeholders to consider further developments in the field. The SAFE project will provide technical solutions, business models and overview of measurable environmental impact.

The results

Through the analysis, four scenarios for the future were identified (Marketplace; Microtrains; CityRoadTrains; and Public goods transportation) that provide insights into how potential business models may be relevant in the future. The initial analysis of differences between the Nordic countries showed that incentives are most developed in Norway, which is evident since Norway has one of the highest electric vehicle penetrations per capita in the world. This indicates that the right level of economic and non-economic incentives can provide a boost for the electric vehicle market. There is also an important role for the municipality to play in order to define what kind of transportation there is demand for in the city centre in the future. Already now, measures can be taken to ease the transfer to electric transportation, such as:

- Allow faster access to the cities for electric vehicles.
- Exchange part of the transportation in the city to electric vehicles.
- Create an eco-label for products transported via electric vehicles or integrate it into existing eco-labels such as the Swan or Ø-branding.

For the industry, the change of the cities in the future will demand a change in setup, which in term will also affect the business model put into use in these scenarios. Collaborative business models have been identified as a potential viable approach and initiatives in several Nordic and European cities are working with the Hub and Spoke model for urban distribution and night distribution, a new approach made possible with electric transportation.

The main challenges and obstacles for the realisation of the electrification of urban transportation are associated with the strategic choices made by the cities and government, where it becomes important to create the right support for electrifying logistics vehicles and non-fiscal incentives to make access easier for these vehicles compared to traditional fossil-fuelled vehicles.

2.1.3 Nordic Electric Avenue – NEA

About the project

The NEA project facilitates a change towards a society with higher shares of electric vehicle car-pooling usage. Building on existing models, the project sets up and expands electric car pool fleets in Copenhagen, Helsingborg, Gothenburg and Oslo to create an electric avenue from Copenhagen up through the Swedish west coast to Oslo; the Nordic Electric Avenue.

Electric Transportation Portfolio

Nordic Electric Avenue

NEA

Project partners
Öresundskraft (SE), Move About (SE, DK & NO) and Gröna Bilister (SE).

Policy conclusions
Governmental incentives need to be increased to ensure economical attractiveness of car sharing by, for example, reducing VAT to the same level as for public transport, reserving specific parking areas and allowing for usage in public transport lanes. In Sweden for example, car pool services has a VAT of 25% while taxi services only has 6%.

The infographic includes a stylized map of the Nordic region with blue circles representing cities and a green dashed line connecting them, symbolizing the electric avenue route.

The objective

- Create the basis for a Nordic Electric Avenue by setting up new electric car pool fleets in Helsingborg, Gothenburg and Copenhagen, as well as including the existing car pool in Oslo.
- Create common IT solutions that enable roaming between car pools across borders, make the use of electric car pools easy, and that facilitate information on electric vehicles in relevant countries.
- Provide opportunities for fast charging to electric vehicle owners and car pool members and thereby make electric vehicle usage more attractive, secure and smooth.

The results

New electric car pools have successfully been introduced in Helsingborg, Höganäs and Klippan (Sweden), while additional car pools were installed in Gothenburg and Copenhagen. In addition, new pool stations are under development in Trollhättan (Sweden) and Oslo and planned for Mölndal, Varberg, Halmstad and Trelleborg (Sweden). A strategically placed fast charging station was installed in Helsingborg, enhancing the possibility to travel by electric car from Copenhagen to Helsingborg and further. A contract for a new fast charger was signed for Trollhättan, securing the area closer to Gothenburg. A solar charging station (carport) was, with much appraisal, introduced in Helsingborg, in connection with the new car pool.

An IT based roaming solution, both for laptops and smart phones, which enables car pool members to find and book vehicles in any of the relevant countries, was successfully developed and launched.

The project has found that the importance of focusing on striking symbols and concrete measures (e.g., the solar charging carport) can serve as a window towards media, users, and decision makers. Car pools are also an even more efficient way of increasing and introducing the use of electric vehicles to new users than expected. Along with that comes positive synergies: more electric cars on the street promotes the visibility of the electric vehicle technology and its feasibility and practicability, as car sharing is a green, modern and sustainable solution for car driving in urban areas both in the Nordic region and abroad.

2.1.4 Incentives and actual cost calculations for electric transport in Nordic countries

About the project

In order to meet political aims of increased sales of electric cars in the Nordic countries, different consumer incentive practices are widespread. The INTELLECT project provides an overview and a comparison of these incentives in all Nordic countries.

Electric Transportation Portfolio

Incentives and actual cost calculations for electric transport in Nordic countries

INTELLECT

Project partners
Icelandic New Energy (IS), VTT Technical Research Centre (FI), Grønn Bil (NO), Nukissiorfiit (GL), SEV (FO), Orkusetur (IS), Danish Energy Association (DK) and AF Industry (SE).

Policy conclusions
The project was mapping the different incentives in the Nordic countries in order to create an overview of the practices, and found out that it is important that both national and municipal governments work together on incentives to promote electrical vehicles. This has for example been the case in Norway. In other Nordic countries the incentives are mostly connected to free parking and free charging (municipal level) while incentives on national level are not on pair with the municipal ones.

The objective

The project objective is to map available incentives in the five Nordic countries, as well as Greenland and the Faroe Islands. The project also looks into specific city incentives. The second objective is to develop an online user-friendly calculator for easy cost comparison between different types of vehicles.

The results

The outcome of the project is a support tool for all interest groups working in the field of electric cars and alternative fuels. It is also a useful tool for vehicle manufacturers in order to see how aggressive the Nordic governments have been in providing incentives for environmentally friendly vehicles. The calculator is available in all Nordic languages at www.orkusetur.is/intelect

Regarding policy, the project gives an overview of what all Nordic governments have initiated to stimulate the sales of electric vehicles. It is evident here that the strong Norwegian incentives have had a drastic impact on the electric vehicle market, as no other country has the same share of battery electric vehicles. Evidently, if there is a strong interest to support the market, then it can be achieved by providing aggressive incentives.

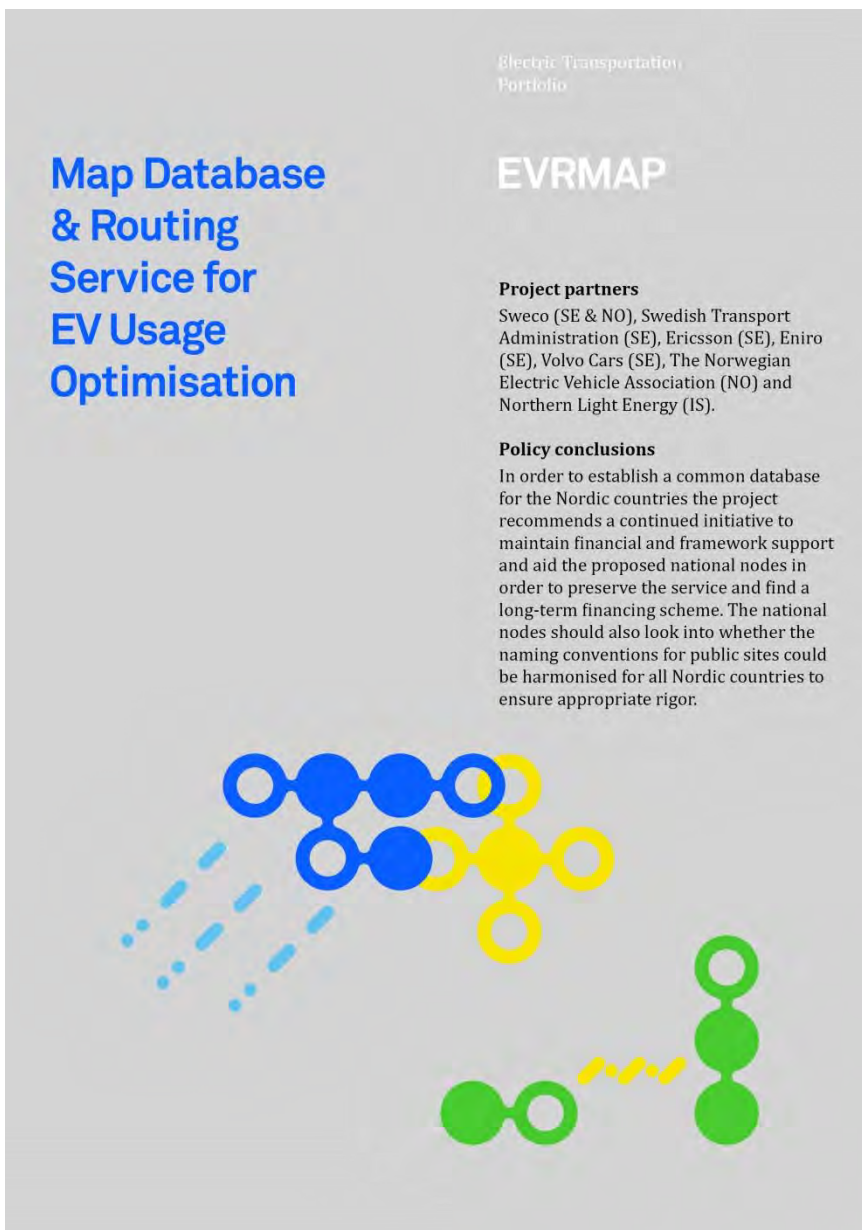
The findings of the project can be used in different segments of the society. The public can use the calculators to attain a visual display of the difference in cost by shifting from conventional vehicles to electric or other more environmentally friendly fuels. In the same manner, companies and institutions can evaluate the implications of shifting to an environmentally friendly fuelled car fleet.

It is important that both national and municipal governments work together. This has also been the case in Norway and has influenced the success of battery electric vehicles. The INTELLECT project team will continuously update the data and matrices during the next couple of years to keep the information alive, as otherwise the work will be obsolete in a relatively short period of time due to the rapid changes of political incentives.

2.1.5 Map Database & Routing Service for EV Usage Optimisation

About the project

As the number of electric vehicles, increases over the next years, so will the demand for a dense network of charging stations. The EVRMAP project provides electric vehicle (EV) drivers with information on where to find charging stations and how to find an effective route between destinations in the Nordic Region.



Electric Transportation Portfolio

Map Database & Routing Service for EV Usage Optimisation

EVRMAP

Project partners
Sweco (SE & NO), Swedish Transport Administration (SE), Ericsson (SE), Eniro (SE), Volvo Cars (SE), The Norwegian Electric Vehicle Association (NO) and Northern Light Energy (IS).

Policy conclusions
In order to establish a common database for the Nordic countries the project recommends a continued initiative to maintain financial and framework support and aid the proposed national nodes in order to preserve the service and find a long-term financing scheme. The national nodes should also look into whether the naming conventions for public sites could be harmonised for all Nordic countries to ensure appropriate rigor.

The poster features a stylized graphic at the bottom consisting of interconnected circles in blue, yellow, and green, with dashed lines indicating connections or routes between them.

Key research questions

- How can a common Nordic database of charging stations be established?
- How to develop a database and administrative interface for actors to maintain the information?
- How can a routing service for EV drivers be developed and what physical factors are most important for an optimised route?

The objective

The objective of the project is to establish a common Nordic database over electric vehicle charging and to collect data over charging points and stations. Additionally, the project will create a prototype of an EV-routing service tool as well as combine industrial actors in the process.

The results

During the course of the project, EVRMAP has successfully launched an administrative interface to maintain the information for all Nordic countries. This administrative setup creates the foundation upon which a common, functional database can be built in the future. A fully established database was implemented in parts of the Nordic region, and setup to the NOBIL database. However, some issues pertaining the gathering of data was not properly solved due to e.g. legal disclaimers of the inaccuracy of gathered data. The project did establish a prototype for EV routing that takes the following physical factors into account when optimising the route: charging station effect, range, elevation changes, energy usage, and regeneration of brake energy. The tool will help users to find the quickest route to the selected destination, including charging time and relevant factors, and can as such find a route optimised for quick and efficient charging over the entire distance. The source code for the tool can be retrieved from Sweco Position AB.

2.1.6 Electric Ship Traffic

About the project

Ship traffic serves 90% of global trade and emits twice the greenhouse gases of air traffic. To target a part of this sector, EleST analyses the future possibilities for renewable energy use on ships. By modelling the energy behaviour functions of different ship traffic segments, the project identifies, specifies and simulates the most promising energy carrier, conversion and supply chain options for maritime traffic.

The infographic is set against a light grey background. At the top right, the text 'Electric Transportation Portfolio' is written in a small, light grey font. Below this, the title 'EleST' is displayed in a large, bold, white font. To the left of the title, the words 'Electric Ship Traffic' are written in a bold, blue font. Below the title, there are two sections of text. The first is 'Project partners' in bold, followed by a list of institutions: Aalto University (FI), Technical University of Denmark (DK), Chalmers University of Technology (SE) and Prototech AS (NO). The second section is 'Policy conclusionsa' in bold, followed by a paragraph of text. At the bottom of the infographic, there are several abstract, stylized icons. On the left, there is a blue icon consisting of four circles in a horizontal line, with a fifth circle above the second one. In the center, there is a green icon with two circles connected by a horizontal line, and a yellow icon with two small circles above it. On the right, there is a blue icon with four circles in a 2x2 grid. Below these icons, there are several dashed blue lines and a solid blue circle, suggesting a network or flow.

Electric Transportation Portfolio

EleST

Electric Ship Traffic

Project partners
Aalto University (FI), Technical University of Denmark (DK), Chalmers University of Technology (SE) and Prototech AS (NO).

Policy conclusionsa
The project proposes that policy measures for alternative fuels in the maritime industry should be adjusted depending on the segment of the ships' conversion efficiency. As such, ships with a high conversion efficiency could be incentivised to integrate more climate-friendly but not necessarily carbon dioxide-free energy systems on board, in order to have a shift towards a more environmentally friendly maritime industry across the whole sector; instead of only focusing on the segment with low conversion efficiency. This would help share the burden of costly measures and ramp up production, testing and demonstration activities spread over several actors.

The objective

The objective is to identify promising paths for integrating renewable energy sources and technologies into ship traffic environment. A scenario analysis outlines necessary investments by ship owners to 2020. Here, the objective is to conceive a temporal techno-economical evolution of promising integration paths.

The results

Results show that in 2012, on-board electrical energy generation systems can compete with the high-cost reference energy systems, and by 2020, they can compete even with the most affordable reference energy systems. However, in most cases the need for additional energy storage will eliminate the commercial feasibility of on-board energy generation systems.

In general, energy efficiency improvements are still the easiest and most cost effective way to cut emissions. Different hybrid solutions are promising, as their market maturity may be greater than with completely new energy systems that do not utilise traditional technologies. When targeting extensive emission savings and producing energy for the prime mover rather than auxiliary purposes, other energy production systems need to be established. Hydrogen combustion in existing but modified on board energy systems appears, from this perspective, attractive when targeting major rapid system changes and emission reductions. Biofuel possibilities are challenging, as biomass volumes are probably too low to be able to secure totally fossil-free energy supply chains for larger shipping activities.

2.2 Sustainable Freight Transportation Portfolio



The overall objective of the call for proposals in the Sustainable Freight Transportation Portfolio was to identify and fund projects that contribute to the Nordic region strengthening its position in the development, testing and use of sustainable freight transport solutions. The projects funded through the call should increase the level of Nordic cooperation in the area of sustainable freight transportation. Funded projects should foster cooperation between different actors such as researchers, industry, NGOs and public organisations. The projects should further increase the knowledgebase in the Nordic region on sustainable freight transport solutions and give recommendations to Nordic decision makers on how to strengthen cooperation in the field, and how to reach the Energy and Transport programme's overall objective. The projects should consist of a consortium with representatives from at least three Nordic countries:

- *Call opening:* 15th May 2011.
- *Indicative project start:* January 2012.
- *Number of project applications:* 12.
- *Total amount of funds applied for:* 18.7 million NOK.
- *Number of funded projects:* 6.
- *Amount of funding from the Energy and Transport programme:* 9.8 million NOK.
- *Total budget of funded projects:* 41.1 million NOK.

The results from the six Sustainable Freight Transportation Portfolio projects are presented below.

2.2.1 Alcohol [Spirits] and Ethers as Marine Fuel

About the project

Alcohol and ethers are interesting fuel alternatives that have not previously been demonstrated in marine engines. SPIRETH tests the use of methanol and di-methyl ether (DME) based fuels in a full-scale pilot project in order to find the best environmental and economic alternative for a sustainable and successful maritime transport industry.



The infographic features a grey background with the title 'Sustainable Freight Transportation Portfolio' at the top right. On the left, the project title 'Alcohol [Spirits] and Ethers as Marine Fuel' is written in green. The central text area contains the project name 'SPIRETH' in large white letters, followed by 'Project partners' (SSPA (SE), ScandiNAOS (SE), Stena Rederi (SE), Wärtsilä (FI), Haldor Topsoe (DK), Methanex Corporation (CA) and Lloyds Register EMEA (UK)) and 'Policy conclusions' (Methanol has shown very good potential as a solution for shipping to reduce emissions, and supporting policies could further develop the relevant technology and systems for vessels using methanol. More development of alternative engine technologies should be supported to level the playing field with supporting policies or subsidies, similar to those that exist for land transport, to encourage the use of renewable fuels in the marine transport industry.). At the bottom, there are stylized molecular diagrams: a blue cluster of four circles, a vertical stack of blue circles, a green cluster of three circles, and a blue cluster of four circles with a trail of yellow dots above it.

Sustainable Freight
Transportation Portfolio

Alcohol [Spirits] and Ethers as Marine Fuel

SPIRETH

Project partners
SSPA (SE), ScandiNAOS (SE), Stena Rederi (SE), Wärtsilä (FI), Haldor Topsoe (DK), Methanex Corporation (CA) and Lloyds Register EMEA (UK).

Policy conclusions
Methanol has shown very good potential as a solution for shipping to reduce emissions, and supporting policies could further develop the relevant technology and systems for vessels using methanol. More development of alternative engine technologies should be supported to level the playing field with supporting policies or subsidies, similar to those that exist for land transport, to encourage the use of renewable fuels in the marine transport industry.

The objective

The main objective is to test the fuels methanol and di-methyl ether (DME) in marine engines. Two project test streams were defined as follows:

- DME: Develop a methanol to DME conversion process plant for shipboard operation of an auxiliary diesel engine, and test the plant and the DME fuel mix on board a ROPAX vessel.
- Methanol: A full-scale marine main diesel engine is to be converted to run efficiently on methanol and tested in a laboratory.

The results

Project results have shown that it is feasible to convert ships to operate on methanol and DME-based fuels, and these fuels are viable alternatives to reduce emissions.

On-board arrangements for methanol storage, distribution, and handling have been designed and installed on the Stena Scanrail, a ROPAX vessel operating between Gothenburg and Frederikshavn. An OBATE™ (On Board Alcohol to Ether) process unit for dehydrating methanol to a fuel mix of DME, water, and methanol was designed and installed on-board the ship.

A retrofit solution was also developed for conversion of a ship's main diesel engine to methanol operation, for testing in a laboratory. Low emissions, high efficiency, robust solution and cost effective conversion were key factors considered when evaluating the different combustion concepts and design solutions. Diesel combustion of methanol with pilot fuel ignition was determined to be the preferred combustion retrofit concept.

The risk & safety analysis in SPIRETH has contributed to the development of ship classification society rules for methanol as a ship fuel. The work has also contributed to the International Maritime Organization's draft IGF code (International Code of Safety for Ships using Gases or Other Low-Flashpoint Fuels). SPIRETH has been of key importance in the development of methanol as a marine fuel and in showing that it is a viable alternative in the Nordic region and the Baltic Sea. Methanol based fuels can contribute to a more environmentally sustainable shipping industry, through lower emissions levels and the potential for fuel production from renewable feedstocks and energy sources.

2.2.2 Nordic Sustainable Logistics Network

About the project

The Nordic Sustainable Logistics Network brings together key players from five Nordic countries to establish a common Nordic network dedicated to improving cross-border business collaboration in the area of sustainable logistics.

The infographic features a grey background with a network diagram at the bottom. The diagram consists of several clusters of circles: two green clusters on the left and right, a blue cluster at the bottom center, and a single blue circle at the bottom right. A dashed yellow line connects the two green clusters. A blue double-circle icon is positioned above the dashed line.

Sustainable Freight
Transportation Portfolio

Nordic Sustainable Logistics Network

NoSlone

Project partners
Insero E-Mobility (DK), Grønn Bil (NO), Icelandic New Energy (IS), VTT Technical Research Centre of Finland (FI), Closer (SE) and University of Gothenburg (SE).

Policy conclusions
In order to transform the Nordic region's transport logistics into being more sustainable, the project has identified certain key areas for policy measures. Special attention should be heeded to increase sales of greener vehicles and fuels (e.g. vehicle taxation based on CO₂ emissions), reduce city congestion (e.g. congestion charges with green zones), greener public procurement (e.g. CO₂ emission limits in call for tenders) and optimised and intelligent transportation systems (e.g. optimisation on existing logistic processes and promote smart operations and open data access).

The objective

The project builds up a Nordic network that focuses on several different aspects of sustainable logistics. This is achieved through close collaboration between five central clusters and network organisations representing each of the five Nordic countries:

- Alternative fuel types (Finland).
- Heavy duty transportation – lorry and bus (Sweden).
- Light duty electric transport (Norway).
- Marine applications (Iceland).
- E-mobility business models and commercialisation (Denmark).

The results

The main outcome of the network is an information portal on sustainable logistics, where both project participants and network members can share news and take part in an extensive database of knowledge and cases (www.noslone.com).

The creation of national networks for sustainable logistics and introduction of a common portal for new knowledge sharing has facilitated successful Nordic cross-border collaboration on sustainable logistics through creation of sub-projects and company collaboration. This has led to several presentations from the project at international conferences, as well as national meetings on the topic in all Nordic countries.

The initiative has also created a foundation for the continued activities on sustainable logistics through the inclusion of and collaboration with NTM (Network for Transport and Environment), who will successively take over the management of the network. The project has also successfully helped establish a green logistics network in Iceland, where there was none before. However, the Nordic countries' inherent differences, as well as differentiated partners, made it challenging to find common denominators that all participants could work toward in the network. The Nordic sustainable logistics sector is diverse with dissimilarly sized companies and contrasting priorities, making the cooperation testing at times.

The political recommendation from the project is for policy initiatives to support the rollout of sustainable logistics solutions, where the most critical point is the understanding of the fact that “cash is king” in the logistics industry, and that incentives should work towards creating comparable business cases for new and clean technologies.

2.2.3 Nordic Intelligent Truck Hub

About the project

The NiHub-project suggests an innovative approach to the interface between long distance and last-mile transport, creating an efficient tool for Nordic cities that can help lower the negative effects that freight transport has on the city environment. The project has focused on both technical as well as business aspects of the concept.

Sustainable Freight
Transportation Portfolio

Nordic Intelligent Truck Hub

NiHub

Project partners
City of Oslo (NO), Swedish Transport Administration (SE), Helsinki Regional Transport Authority (FI), SINTEF Technology & Society (NO), Sweco (SE) and Traficon (SE).

Policy conclusions
The necessary measures needed in order to support the NiHub distribution concept are mainly based on long-term investment costs, where the municipalities must be able to sustain operations for a longer period in order to gain the societal benefits (e.g. CO₂ emission reductions, improved local environment and decreased city congestion). As such, measures should be taken to support the NiHub concept on local level, to provide for successful private-public-partnership models, fiscal incentives (e.g. congestion taxes) and demands for NiHub utilisation in public procurement contracts.

Key research question

“How to relieve urban networks from heavy trucks by exploring the synergies of a combination of intelligent services for truck parking information for last mile delivery and Urban Consolidation Centres?”

The objectives

- Develop a NiHub concept for the Nordic region.
- Assessment of preconditions for deployment.
- Explore how to create a concentration of goods and incentives to use the NiHub.
- Assess the economic aspects of the NiHub concept by developing a business model.

The results

The concept with a combination of consolidation and Intelligent Truck Parking has shown to be a fruitful approach to relieve urban city networks from heavy trucks, and the NiHub could be one solution to this.

When the NiHub concept was applied at the Helsinki, Stockholm and Oslo test sites, the emission calculations showed great reduction potential in CO₂ emissions with scenarios using realistic routes by green last-mile delivery vehicles. A business model was developed for each individual site showing the distribution of the NiHub cost elements between actors, and a trust model showing roles and responsibilities by ARKTRANS⁶ as input to national decisions for implementation.

However, the questions of investment and operation costs are important issues for the future of the concept. Substantial investments are required in both land and IT-infrastructure, and are considered to be of a magnitude that a potential private NiHub operator would not want to risk investing in without some public financing support.

The results show that the concept is highly promising and appreciated by all concerned stakeholders, but there are some obstacles to overcome before a NiHub concept can be established, as well as be financially viable in the Nordic countries. Ways to overcome the obstacles are by incremental deployment on an already existing terminal owned and operated by a private stakeholder, and an ambitious city enforcing incentives that change the current city distribution behaviour.

⁶ A multimodal framework architecture for intelligent transport systems in Norway, www.arktrans.no

2.2.4 *Nordic comparison on the future of road freight energy efficiency and CO₂ emissions*

About the project

The purpose of NORFREN is to compare and forecast the development of energy efficiency and CO₂ emissions of road freight transport in Denmark, Finland, Norway and Sweden. By doing this, the project provides adequate information for international evaluation of the Nordic countries and policy measures to govern the future direction of energy efficiency and CO₂ emissions reductions measures for road freight.



The infographic is set against a light grey background. At the top right, it reads 'Sustainable Freight Transportation Portfolio'. On the left, the title 'Nordic comparison on the future of road freight energy efficiency and CO₂ emissions' is written in green. The main title 'NORFREN' is in white. Below it, the 'Project partners' section lists: Transport Research Centre Verne (FI), Tampere University of Technology (FI), Technical University of Denmark (DK), Institute of Transport Economics (NO) and University of Gothenburg (SE). The 'Policy conclusions' section states that energy efficiency measures were not primarily driven by national transport policies, but by cost savings due to rising fuel levels and fierce competition. It concludes that policy makers should focus on measures affecting the cost of operations based on fuel (e.g. taxation, subsidies for alternative CO₂-free fuels or empty running limitations) or on the modal-shift approach where investments are made in other transport modes rather than road, such as infrastructure for railway and maritime freight transport. At the bottom, there is a stylized graphic of blue and green circles and lines, with a yellow circle on the right.

Sustainable Freight
Transportation Portfolio

NORFREN

Project partners
Transport Research Centre Verne (FI),
Tampere University of Technology (FI),
Technical University of Denmark (DK),
Institute of Transport Economics (NO)
and University of Gothenburg (SE).

Policy conclusions
The project found out that energy efficiency measures were not primarily driven by national transport policies, but by cost savings due to rising fuel levels and fierce competition within the market. Policy makers should therefore focus on measures that will directly affect the cost of operations based on the fuel (e.g. taxation, subsidies for alternative CO₂-free fuels or empty running limitations) or on the modal-shift approach where investments are made in other transport modes rather than road, such as infrastructure for railway and maritime freight transport.

The objective

The project objective is to improve knowledge on energy use in road freight transport and to better understand the relationship between economic activity and CO₂ emissions in the sector. More specifically, this was achieved by investigating the historical development (2000–2010) of road freight transport in all Nordic countries (except Iceland). Transport statistics, haulier surveys and workshops were used to gather information, and on the basis of these studies were the future energy efficiency and CO₂ emissions forecasted.

The results

Reaching the CO₂ emission targets for the year 2030 is challenging yet possible based on expert forecasts and in the light of the project's scenarios. However, the target can be achieved with very different development paths, e.g. the structure of the national economy and the volume of transport seem to vary widely in the different scenarios. In the proposed recommendations on measures for achieving the targets, cooperation and division of responsibilities between various stakeholders of the road freight sector is key.

From the haulier survey, the project found that:

- Energy efficiency indexes proved to be a very useful tool for comparing the hauliers.
- The shippers' interest in the hauliers' performance improves the level of energy efficiency.
- Fuel monitoring practices are fairly similar in the four Nordic countries.
- The level of implementation of energy efficiency measures is similar in the four countries.

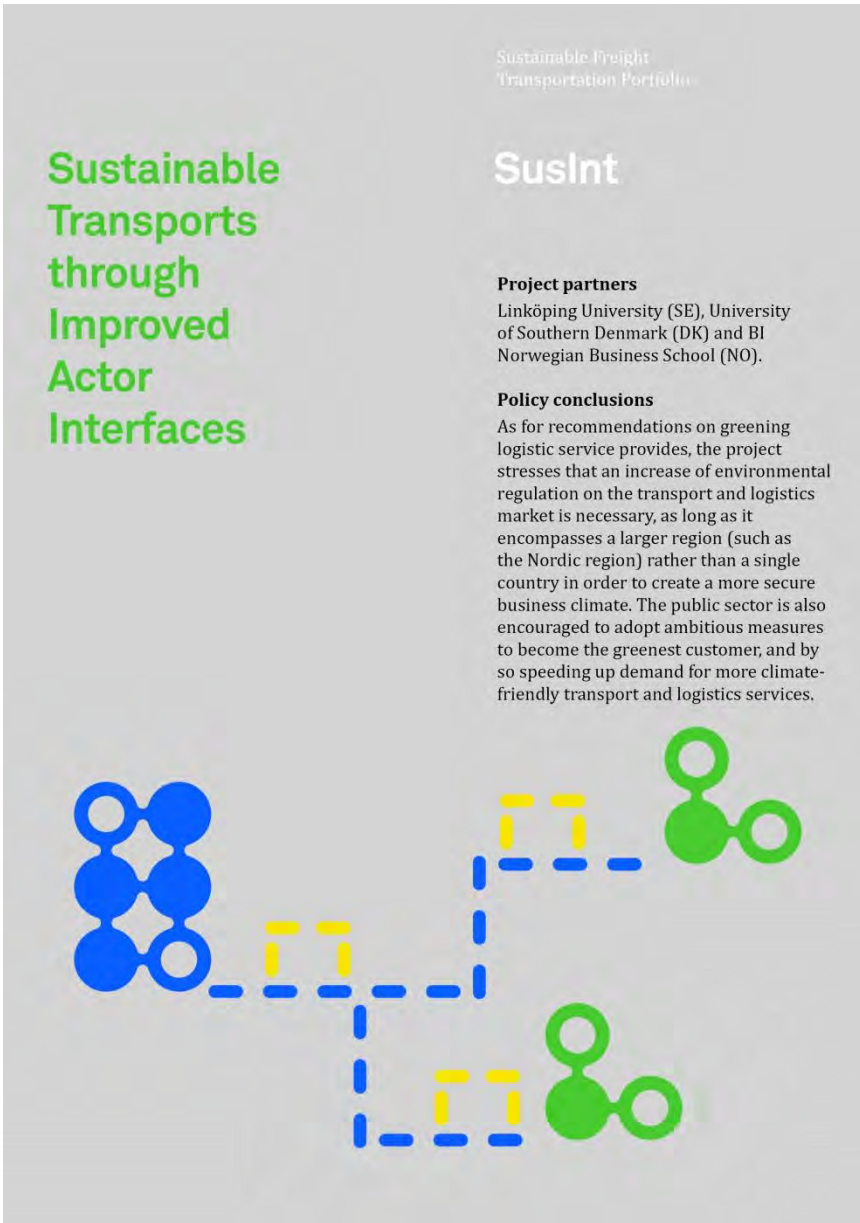
The results show that the Nordic countries have not succeeded in significantly improving the energy efficiency of the road freight sector. Denmark is the only country that has been able to improve energy efficiency and to reduce CO₂ emissions of national road freight transport.

Looking further at the developments, Norway has the biggest challenge ahead in order to achieve the future sustainable development targets due to the projected increase in share of goods transported by road in Norway.

2.2.5 Sustainable Transports through Improved Actor Interfaces

About the project

The SusInt project addresses the question of how logistics and transport systems can become more environmentally sustainable. The stance taken is that the business models of Logistics Service Providers (LSPs) and their customers do not match, which impedes the provision of more environmentally friendly services.



Sustainable Freight
Transportation Portfolio

**Sustainable
Transports
through
Improved
Actor
Interfaces**

SusInt

Project partners
Linköping University (SE), University
of Southern Denmark (DK) and BI
Norwegian Business School (NO).

Policy conclusions
As for recommendations on greening
logistic service providers, the project
stresses that an increase of environmental
regulation on the transport and logistics
market is necessary, as long as it
encompasses a larger region (such as
the Nordic region) rather than a single
country in order to create a more secure
business climate. The public sector is also
encouraged to adopt ambitious measures
to become the greenest customer, and by
so speeding up demand for more climate-
friendly transport and logistics services.

The poster features a network diagram at the bottom with blue and green nodes connected by dashed lines, representing the project's focus on actor interfaces.

The objective

The purpose of the SusInt project is to analyse the interface and the interplay between LSPs and their customers, e.g.:

- Identify the level of cooperation among the actors, and the drivers and barriers to cooperation.
- Explore the business models among logistics service providers and their customers.
- Assist in improving sustainability and competitiveness for logistics companies, and consequently for supply chains in the Nordic region.

The results

The results from the project show that the degree of cooperation between LSPs and their customers differ between the Nordic countries, despite otherwise comparable sizes, owner structures, service scope and strategies. Still, the expectations for cooperation with LSPs vary between customers in different countries; while the lowest degree of cooperation is identified in the Danish case, the highest appreciation of cooperation is seen among Danish customers.

Environmental aspects are not prioritised among the customers. This is an important barrier for the LSPs to develop greener business models. As such, environmental improvements rely on the design of LSPs' networks, which in turn depends on the LSPs' customer bases and customer demands. Different business models constitute a challenge; logistics companies focus on relationships and network design, while their customers focus on products and supply chains. Legislation is not considered as a driver in greening logistics, as it is a customers' market. Given that, the results indicate that regulatory measures could potentially be aimed towards customers of the LSPs instead.

The results highlight the importance of researching the greening of logistics and transport not from a single company or relationship perspective, but rather from a network perspective. Such an approach allows for increased understanding of the complex interaction patterns, which in turn can generate more innovative solutions to the problem of greening transports and logistics in the Nordic region in particular, and the international context in general.

2.2.6 Light Weight Freight Transport

About the project

Successful joining methodologies between dissimilar materials are key enablers for the introduction of novel lightweight materials, such as carbon fibre reinforced plastic composites (CFRP), in heavy trucks and buses. By lowering the structural weight of such vehicles, the energy consumption per ton-km can be reduced to the benefit of the environment and society. The LiFT project has successfully demonstrated feasible joining methodologies and concepts for metal to carbon fibre composite (CFRP) joints for the above-mentioned applications. The LiFT project is a part of the Nordic vision to become the test market for greener and more efficient transport.

Sustainable Freight
Transportation Portfolio

Light Weight Freight Transport

LiFT

Project partners
Royal Institute of Technology (SE),
Scania (SE), Technical University of
Denmark (DK), Fiberline (DK), Norwegian
University of Science & Technology (NO),
Brødrene Aa (NO) and SINTEF (NO).

Policy conclusions
There are currently no prescriptive
rules or regulations that prevent
lightweight solutions and carbon fibre
materials in trucks and busses. As such,
since the project has fully focused on
technical aspects, there are no policy
recommendations based on the results
from the LiFT project.

The objective

The LiFT project addresses the challenges of introducing new lightweight multi-material systems in trucks and buses by focusing on one of the main technical challenges: hybrid-joining techniques. The objective is to address:

- Design methodologies for lightweight composite part integration in chassis structures.
- Long-term behaviour of multi-material joints.

The results

The LiFT project has proposed a novel truck/bus chassis design using carbon composites that can result in 50% weight reduction and a dramatic part number reduction (>75%). Three conceptual designs for the joining of load bearing CFRP to metal structures were initiated. This has resulted in:

- A novel hybrid joint that will indicate early signs of failure with residual load bearing capacity.
- An integrated monitoring system for adhesive joint testing under fatigue loading.
- Proposed and demonstrated state of the art methods for strength prediction of multi-material joints, such as an efficient method to predict the first micro-buckling failure in composites and a cohesive fracture mechanics approach to predict joint failure.
- A multidisciplinary Nordic research and industrial consortium with unique competences.
- New Nordic cross-border industrial collaborations (Scania and Brødrene Aa) on lightweight structures for transport.
- Agreeing on future joint applications (EU, National or Nordic if available) for the consortium.

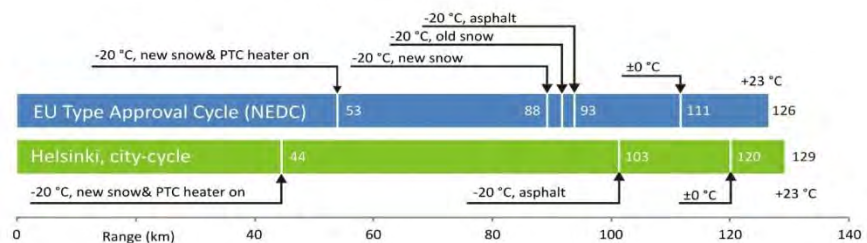
The technical results will be published in peer-reviewed journals and presented through the national industrial lightweight and composite networks throughout the Nordic region and internationally.

3. Project showcase

3.1 Focus: Range & Performance of Electric Vehicles in Nordic Driving Conditions

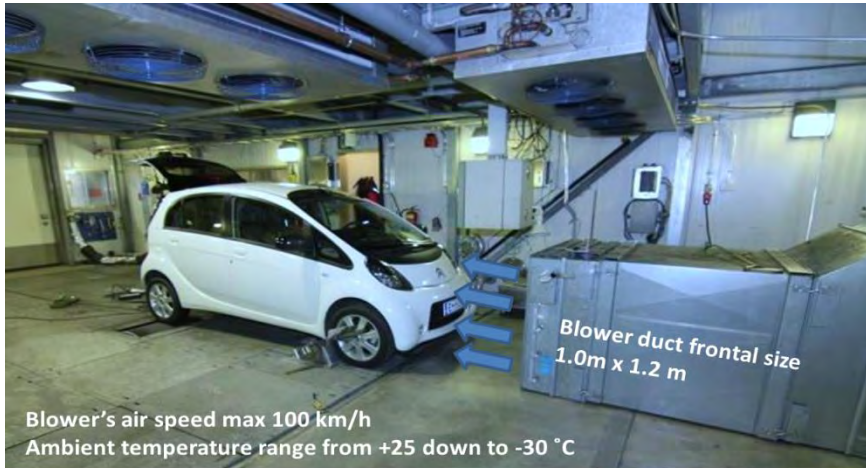
The RekkEVIDde project is a prime example of mutually beneficial Nordic cooperation. The Nordic region share many characteristics for driving conditions when it comes to climate, distances, infrastructure and fuel prices. The project looks into a highly relevant topic of future successful electric vehicle (EV) penetration in the market, where the perception of EV performance and range under different driving conditions varies greatly. Accurate consumer information can be scarce on EVs in the market, especially when operating the car in the Nordic region. The RekkEVIDde project takes one step forward to tackle this debate, and has through laboratory tests and extensive field testing compiled information on EV usage and performance under Nordic conditions.

Picture 1: Range of a Citroën C-Zero under different climate and driving conditions, seen through two different test cycles



The results depict several challenges for EVs in the Nordic region, where cold weather and adverse road conditions increase the driving resistance and thus shortens the range of the car. In addition, cold weather imposes slower charging and battery warming. The most drastic change however is the range and performance drop when cabin heating is activated in the car, which is highly necessary when outside temperatures drops to under the freezing point. Heating and ventilation in the car consume very high amounts of prime battery energy, and as such is the range drastically reduced; total EV range can be reduced with up to 76% in -23 °C conditions with cabin heating on as compared to +23 °C and no heating activated.

Picture 2: Laboratory tests at VTT in Finland



The testing further demonstrates that additional research is needed on new generation heat pumps and fuel-energy heaters in cars that can lessen the impact of using energy from the battery for cabin heating. The relative impact of cabin heating in urban areas with high congestion and traffic jams is another key aspect that the project feels more efforts are needed in. Evidently, the biggest factor for consumers experiencing dramatically reduced range in cold conditions is the use of the heater. Cars with internal combustion engines (ICE) are much less efficient than electric motors but do instead produce a lot of waste heat that can be used to heat the inside of the car. In an EV, this heat comes in addition to the energy required to propel the car forward, and therefore is a significant drain on battery performance.

“It’s not the battery that’s the problem in cold weather, it’s the heater.”

Arto Haakana, RekkEViide Project Manager

An important factor in this becomes evident when ample consumer information is scarce and largely inaccurate of the operations of an EV in the Nordic region. The project has as such developed a concept of an EV label that can help promote accurate information of EVs in the Nordic market. The EV label is still in a development phase, but it still points to an interesting avenue to pursue further for additional consumer information and market awareness. The United States Environmental Protec-

tion Agency (EPA) has its own energy label called Fuel Economy,⁷ with a dedicated version for EVs that display crucial information such as range, annual fuel costs, savings compared to average fuel costs for a new car, CO₂ emissions and more. This is an excellent step to showcase the EV as compared to traditional ICE cars, and an adapted label for the Nordic countries could contribute to better consumer information that can further increase EV market penetration. The RekkEvidde label takes into consideration other factors too, which the EPA lacks, such as urban and rural driving, climate and road conditions. This further points to the need of that consumer information and EV market awareness needs to be increased.

“The main problem with EV range is not the range itself, but marketing that promises too much to the consumer.”

Ole Henrik Hannisdahl, RekkEvidde project partner

The RekkEvidde project has as such created a new tool to provide better awareness to EV manufacturers and better knowledge to EV users on the performance and range of EVs under different conditions. This area is largely underdeveloped and the project has taken a first important step to heighten the awareness within the EV industry.

Picture 3: RekkEvidde EVs during field-testing in the north of Sweden



⁷ www.fueleconomy.gov/feg/label/learn-more-electric-label.shtml

3.2 Focus: Nordic Electric Avenue

The NEA project looks at electric vehicles from another angle, when introducing them as a viable CO₂ neutral transportation-sharing alternative. The overall accomplishment is not only to introduce EV car pools, but a common concept and a solid business model. The project sought out to develop a Nordic Electric Avenue from Denmark up along the Swedish west coast further on to Oslo by adding EV charging stations and EV car pools along the way. Combined with this achievement of a Nordic highway of EV usage possibilities, the concept assumes a textbook match for a future fossil-free transportation fleet when EV carpooling caters to both the concept of *modal shift* and *fuel switch*.⁸ Not only does the car pool represent shifting away from the mode of personal transport that results in congestion, natural resource exploitation and higher costs, but the switch of fuel from CO₂ intensive petrol and diesel cars to EVs has a direct effect on total CO₂ emission. The project has calculated that during the project period 11.2 metric tonnes of CO₂ have been saved compared to if lean vehicles (95 grams of CO₂/km) had been used for the same distances covered.

Another important feature is that the project had lengthy plans on seamlessly combining EV carpools with other modes of public transportation, for example trains. This was sadly not realised due to the prospective partner DSB First ceasing operations. However, this still represents a breakthrough opportunity when combining public transportation with climate-friendly carpooling for optimal flexibility and CO₂ emission reductions. Other public transportation actors (e.g. Västtrafik) have expressed interest in future cooperation, so the transition to seamless EV car-pooling from fossil-fuel car rentals need not be long gone.

⁸ See for example OECD/IEA 2013, p. 107

Picture 4: The solar carport in Helsingborg, Sweden; three EVs powered by 40m² of solar panels



The most prolific part of the NEA project was the introduction of an EV carpool in Helsingborg charged by a solar panel mounted atop the EV parking space. The coined “solar cars” gained a tremendous amount of media interest and became a striking symbol of locally produced energy for sustainable transportation. The realisation of that your driving can be powered by solar panels the size of your parking space instead of with expensive and polluting fossil fuels became a powerful tool for EV marketing. Such symbolic value is paramount for gaining market value and display what renewable energy can produce; clean and free energy for your car.

Moreover, several new car pools were successfully introduced during the project period, with the main bulk of them on the west coast of Sweden. New EVs were also added to existing pools, and a number of new municipalities have shown interest in supporting EV car pools that will likely result in additional pools in 2014 and beyond. The important perimeter here is the private-public partnership that needs to coexist in order for the pools to take off. The NEA project can show that the EV carpools themselves are powerful tools for highlighting the benefits of both EVs and car pools in general. Early adopters are seen as tech-savvy and environmentally conscious drivers, who will act as ambassadors for future EV car pool members. There has also been a tendency of younger people as early adopters, which may indicate that those generations might be valuable target groups for marketing and usage optimisation. This can further be a viable strategy to introduce EVs in new markets and to new market segments.

Picture 5: Advertisement for solar charged EVs



“We put the solar-powered charging station where people could see, and suddenly everyone was talking about the ‘solar cars’.”

Mikael Kilter, NEA project partner

The project has also contributed to develop a new IT tool and roaming solution that was implemented during the project period. This service is borderless, meaning that the same application can be used in all of the involved Nordic countries (Denmark, Norway and Sweden). This enables seamless transition from one end to another, and as such creates a common proof of concept for the entire Nordic region. The application can be used on both computers and smart phones and enables roaming between car pools. This highlights the added value that the Nordic region can obtain when pursuing the same goals, where the service providers think regionally and border-free instead of tied to national markets. A common Nordic EV carpool interface is a powerful mechanism to have more users choosing EVs and EV car pools than before, which will help spur on the development of modal shift and switch fuel adoptions to further decrease CO₂ emissions from personal transportation.

Picture 6: EV carpool booking interface on a smart phone



3.3 Focus: Alcohol [Spirits] and Ethers as Marine Fuel

The SPIRETH project is another success-story that demonstrates that Nordic funding can be of invaluable importance in order for companies to embark on a more sustainable path. By choosing methanol as a fuel instead of heavy fuel oils, new opportunities arise on how to effectively reduce sulphur oxide (SO_x) emissions and nitrogen oxide (NO_x) emissions in the short to medium-term, as well as CO₂ emissions in the long term. The need for a new marine fuel alternative stems from measures to control polluting emissions (e.g. at International Maritime Agency and European Union level)⁹ that introduces designated SO_x Emission Control Areas (SECAs) in the North Sea/Baltic Sea with maximum SO_x content levels from 2015 and likewise for NO_x content from 2016 (NECAs). The SPIRETH project has gathered the necessary expertise both from the Nordic region and abroad, in order to tackle the challenge and provide for a more environmentally friendly maritime shipping industry in the future.

Picture 7: Stena Scanrail with test installation of auxiliary engines adapted to run on dimethyl ether (DME) fuel mix



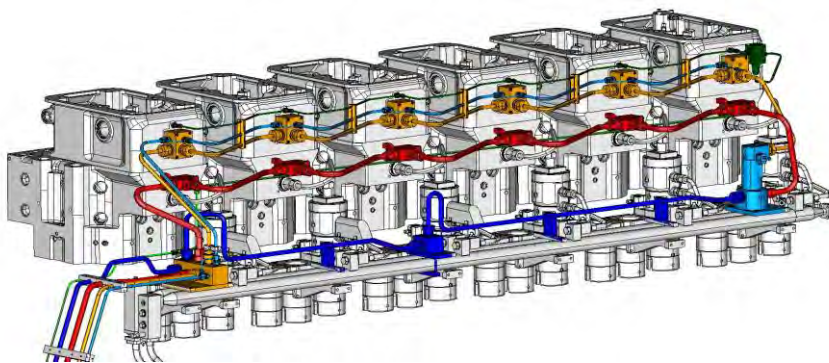
The project approached the challenge through a dual approach to prove methanol applicability, firstly as an on-board OBATE™ conversion of

⁹ See for example Directive 2012/33/EU amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels and IMO Revised MARPOL Annex VI, regulation 13.

methanol to dimethyl ether (DME) to prove operational usage in auxiliary engines in a commercial environment, and secondly to retrofit an existing main diesel engine to run effectively on methanol. Since neither alternative had previously been tested and accomplished in marine engines, the project provided much needed research on an array of different methods of introducing alternative fuels for the maritime industry, such as feasibility of operations, retrofit solutions, safety, standards, infrastructure and logistics. Arrangements for methanol storage, distribution and handling were designed, assessed from a safety and risk perspective, and installed on the *Stena Scanrail* – a ROPAX vessel operating between Gothenburg and Frederikshavn.

Safety and risk assessments were key components in the project, which has profound impact on future developments in the field. Safety measures such as double-walled fuel pipes, hooded fuel rail on the engine and new ventilation systems contributed to achieve an appropriate safety level. Since the project was the first to test methanol as a marine fuel, there were no specific rules governing the use of methanol and DME as fuels on board a ship. Existing rules, standards and codes applicable to marine applications were reviewed to identify those that were considered relevant. The main focus was on liquefied natural gas (LNG), but with methanol being a liquid at ambient pressure and temperature it is perhaps more similar to traditional liquid fuels than to gases. However, the extensive work conducted within the project consortium on risk and safety analysis has contributed to the development of ship classification society rules for methanol as a ship fuel. The work has also contributed to the International Maritime Organization's draft IGF code (International Code of safety for Ships using Gases and Other Low-Flashpoint Fuels). This represents a major advancement in the industry that has been developed in the Nordic countries for the international arena.

Picture 8: Wärtsilä-Sulzer 8 cylinder Z40S drawing with additional piping modifications to test methanol as a marine fuel



There is currently a solid industry commitment to pursue further the alternative of methanol as a marine fuel to switch fuel from heavy fuel oils to more environmentally friendly alternatives. Methanol is also a practical alternative to LNG since the distribution of LNG is very different from current infrastructure and logistics for ships, while methanol can use existing infrastructure and operational aspects from known industries (e.g. the chemical industry).

“Distribution of methanol is not a significant problem since it can build on existing infrastructure for the chemical industry.”

Joanne Ellis, SPIRETH Project Manager

The SPIRETH project has been of key importance in the development of methanol as a marine fuel and in showing that it is a sustainable alternative. Methanol and DME fuels can contribute to a more environmentally sustainable shipping industry, through lower emission levels and the potential for fuel production from renewable feedstocks and energy sources. When renewable methanol becomes more widely available, it can be used to supplement or replace methanol produced from fossil fuel, and allow ships operating on methanol to reduce their carbon footprint and become less dependent on fossil fuels. This becomes especially applicable in the Nordic region when current CO₂-neutral methanol production is expanding on Iceland (e.g. in the Nordic Energy Research funded project *CO₂ Electrofuels*).¹⁰ Methanol as a SO_x, NO_x and CO₂ low content emission fuel is foreseeably a prime candidate to help mitigate climate change and reduce local pollution from the maritime industry in the Nordic countries and abroad, and is something that is happening already today in order to meet future challenges.

¹⁰ Hydrocarbon-based fuels (e.g. methane, methanol and DME) that are produced by combining CO₂ from sustainable sources, such as biomass, with hydrogen produced by new, efficient electrolysis techniques. More information available at www.co2-electrofuels.org.

4. Results



4.1 Nordic Innovation perspective: Where is this green valley?

By Hans Fridberg, Senior Adviser at Nordic Innovation

The epithet of the Nordic region as the green valley of Europe might not be blossoming yet, but big bold goals do plant the seeds, and the Energy and Transport programme is proof that numerous Nordic entrepreneurs and innovators are working hard behind the scenes to cultivate it. The projects funded through the programme are very different in theme and scope, but they have in common that they challenge the status quo of the carbon-intensive transport system and push new ideas in EVs, fuels, materials and logistics planning towards their market potential.

The LiFT project, with its consortium of Swedish truck producer Scania and leading knowledge institutions, are using the classic innovation model of taking well-established technology from one business sector and applying it in another.

The advanced material sciences that are prevalent in aviation and wind energy have promising prospects within heavy transport. Lighter trucks simply means cheaper and more energy efficient transport of goods and people.

A range of projects including RekkEvidde, SAFE, EVRMAP and INTELLECT are trying to help potential future EV users in dealing with some of the concerns that can come from the disruptive change that EVs represent, such as range anxiety and lack of investment security. The SPIRETH project is testing out a brand new propulsion system for ships run entirely on methanol. It is the first of its kind, the potential is huge and now it has been proven that it can work.

However, even for the valiant efforts of the Energy and Transport programme's projects, the fact remains that change in the transport sector has been slow and the fuels that propel our transport system are still almost exclusively fossil. But before we despair, it might be worth revisiting some of the truisms of how innovations diffuse and radical new ideas spread. A reminder that the work undertaken here is necessary for the change we want in our transport system (Rogers, 2003).

Firstly, new ideas spread much more slowly than we expect. A few examples could be the electric car, which has been around for a century, and commercial sailing ships that were operating long into the 1950's. We tend to get frustrated when obvious good ideas do not take over the world immediately, but the fact is that a myriad of factors have to align for a good idea to take off, and that often takes time and effort. Patience and perseverance can be very good tools.

Secondly, it takes time to work out the business model. New ideas, especially if they are disruptive to the existing system, are often difficult to make profitable and need the right business model to take off. This is one of the main reasons why new ideas are often slow to spread, and it takes trial and error to find the right business approach. Recent collapse of the large EV business model gamble by Better Place should not discourage experimentation, and actors such as the partners behind the Energy and Transport programme's Nordic Electric Avenue are doing the right thing in trying out various ways in which to get the public invested in EV use.

Thirdly, disruptions start in niches. The Toyota Prius used to be for people with extra cash who wanted to advertise the green credentials and many seemed hesitant to embrace the new technology. Now the Toyota Prius is the third most sold car in the world. By definition, all ideas start as niche ideas and it takes critical mass to accelerate the ideas that are worth it. Nordic cooperation makes niche markets a little less niche and by pooling our investments, research and innovation efforts we can get there sooner. Finally, slow diffusion makes it easy to mock new ideas and write them off as unrealistic or inconsequential. The revolution we need in sustainable transportation is neither unrealistic nor inconsequential and it will have to come eventually. However, much hard work needs to be done to make it happen, and the Energy and Transport programme is an example of that hard work. We need more of the same for the green valley of Europe to blossom.

4.2 Programme results

Looking back at the starting point of the initiative and the ensuing Energy and Transport programme, the results comprise the knowledge gained, the research-gaps that have been filled, the cooperation lessons learned and the Nordic collaborative actions. The assessment of the results of the programme takes into account the broad starting point of the initiative. The strategy of narrowing the thematic scope down to two differentiated calls was crucial to uphold a practical feasibility within the funding framework and given objective. The first call, Electric Transportation Portfolio, was early identified as the priority at the time where developments were advancing quickly. The Sustainable Freight Transportation Portfolio on the other hand, had not seen as rapid progress in its sustainability work, and was identified as an important area where support was needed to initiate much needed developments.

Based on the goals formulated for the Energy and Transport programme (*cf.* 1.2 – Objective and strategy, indent a. – f.) and given the output of the projects and the programme, the results point towards a successful outcome. Nordic cooperation within energy and transport is evidently both logical, necessary and possible. This joint effort has created a common programme that has reduced duplicating, fragmented and overlapping research while laying the foundation for future cooperation in the field and adding value to the projects' partners and countries. The programme has enabled the Nordic region to continue as a pioneer on new energy technologies and sustainable transportation with innovative cutting-edge research, sound business developments and climate-friendly policy recommendations.

Responding to the more concrete goals, the programme has successfully collected a comprehensive picture of the Nordic region's strengths and priorities within the area, as well as gathered information on existing technologies and fuels to set the strategy for the short and medium term future. Initial background research was conducted (through e.g. the Icelandic chairmanship study)¹¹ and through thematic workshops and strategy meetings with key stakeholders, as well as the mapping initiative,¹² to explore the current standings on initiatives and regulations in the Nordic region.

¹¹ See www.nordicenergy.org/wp-content/uploads/2012/02/Foresight-Analysis-Nordic-Strategies-for-Renewable-Transport.pdf

¹² See www.energyandtransport-efforts.net/

In addition, the programme successfully established a Nordic network within sustainable transportation, where the two calls have brought together twelve different Nordic consortiums to conduct research and business development on pivotal challenges. The network has been handled and coordinated by the Energy and Transport programme's Secretariat (managed by Nordic Energy Research and supported by Nordic Innovation), with coordinated communication activities, a common website and news distribution. The projects' results have also been disseminated in a coordinated Nordic fashion; as written final project reports, at the Energy and Transport programme's midway and final conferences, and in this final programme report.¹³ A key response from the project participants has consistently been the added value of the Nordic network that was created, where new partnerships have been struck, knowledge and expertise have been shared and new collaborative project ideas taken root.

The programme helped developed framework conditions for business opportunities within climate-friendly transportation and energy technologies. Several projects, such as NEA and SPIRETH, have made ground-breaking advancements in their respective fields, while contributing to new solutions for sustainable transport and applied them on both national, regional and international arenas. Other projects, such as INTELLECT and SAFE, have enhanced the knowhow on policies for promoting sustainable transport, which in turn can help policy makers implement successful instruments in the future. Most projects have had a sound mixture of project participants from both industry, regional and national authorities, academia and businesses from all the Nordic countries. This has contributed to lay the foundation to enable better-suited regulatory framework conditions for business opportunities in the future, e.g. through the SPIRETH, NEA and RekkeVidde projects. Much of the business development was made by the projects through their research and implementations, for example in NiHub where the project consortium consisted of and worked closely with local public authorities to meet their objectives. Other efforts have been secured through different Nordic and national institutions, for example through national prospective coordination of joint calls in the future. The Energy and Transport Board has annually updated on the progress and status of the programme to the Nordic Council of Ministers' Energy Minister meeting

¹³ See Appendix for a more comprehensive list of the programme's key communication activities.

containing recommendations from the programme that can induce a better regulatory framework for business opportunities.

The Energy and Transport programme has also, through the work carried out with the strategic mapping in the beginning up to the project's results, identified further Nordic cooperation areas within the sustainable transport sector. The feedback from the projects has been very positive on future work on Nordic cooperation, and especially the electromobility portfolio has shown a continued surge and rapid developments. As such, the Energy and Transport Board proposes a continuation of the essence of the Energy and Transport programme, by creating a platform for future knowledge-sharing, networking, project dissemination and project formulation as well as joint problem solving (described detailed in chapter 16.2 – The future of Nordic energy and transport cooperation). There has also been a focus on international cooperation and to appropriately disseminate the programme's results on a political level, where presentations have been made at various major national and international conferences (e.g. Electric Vehicle Symposium (EVS26) in Los Angeles, CA, United States, and Electric Vehicle Symposium (EVS27) in Barcelona, Spain). The final project results have been presented at an Energy and Transport programme conference to key stakeholders, and yearly status reports and recommendations have been submitted to the Nordic Council of Ministers.

The main activity, to fund and promote Nordic cross-border projects in the two thematic calls, have been both rewarding in terms of added Nordic expertise in the field, and also in terms of keeping consistency to the cause of the Globalisation Initiative to ensure that the Nordic region works towards solving truly global problems.

4.2.1 Nordic value

Looking at the results from the programme there is no doubt that the Nordic region benefited from the work within the Energy and Transport programme. The programme has shown the value and applicability of common Nordic research on mutual challenges that have created new opportunities for researchers, industry and business concepts and relevant policy support. By bringing together Nordic research organisations, innovation clusters, industry and technology leaders has the Energy and Transport programme facilitated joint collaborations and strengthened the Nordic identity in sustainable transportation.

Along with this comes enhanced Nordic competitiveness where the programme has assisted the expertise available in the Nordic region and contributed to pool the necessary resources and knowledge to spur technology developments and research, and at the same time allow for greater information sharing through the Nordic network that came along the programme. Duplication and fragmentation in research and policy initiatives have been avoided to the benefit for research and innovation as well as the implementation and feasibility of long-term policy goals. This pan-Nordic perspective has contributed to effective and efficient research, while still suitable in the overall Nordic innovation climate to spur on further Nordic added value.

4.2.2 Programme applicability

The results of the programme have a high relevance to global climate change, where sustainable transport is a key concept for a future decarbonised scenario – research suggests that the Nordic transport sector must decrease CO₂ emissions from 80Mt to 10Mt by 2050.¹⁴ The outcome of the programme has also an international relevance on the policy side where the Nordic region can demonstrate leading research and innovation projects by sharing best practices, while also advocating for new and revised policies at both EU and international level. The Nordic region has been involved in an unprecedented growth of electric vehicle sales (especially in Norway), and continues to lead the developments that can deliver increased export of smart sustainable solutions and technologies.

A potential impact of the Energy and Transport programme can be seen as the strengthening of the perception of the Nordic region as a leader and expert on new energy technologies for sustainable transport.

¹⁴ OECD/IEA, 2013, p. 9.

4.3 The future of Nordic energy and transport cooperation

Based upon the results from the programme, the response from the project participants and the wishes of the Board of the Energy and Transport programme, there is an evident need for a continuation of energy and transport cooperation in the Nordic region. The Energy and Transport programme has contributed to new expertise, knowledge sharing, novel projects, innovative ideas and business models.

The next logical step would be to build on from the programme's positive results to take another step forward within Nordic transport cooperation – something new, needed and inspiring. The programme has formed a network of companies and research organisations that see the benefit of working together for the greening of transport. Collaboration has been appreciated as meaningful, pioneering and highly beneficial from both project partners, stakeholders and the organisations represented by the Board. Specific Nordic conditions, transport distances and the Nordic energy market are factors that motivate collaboration. Even if the strategic goal for a company and for the public sector is on European level, the Nordic can very much be considered the home market.

The Board of the Energy and Transport programme recommends the establishment of a *Nordic Energy Transport Platform*. Such a platform should start its activity as a two-year project, in order to gain experience of the feasibility of the approach.

The concept of a platform – or a network arena – is the most appropriate way to follow up on the Energy and Transport programme. The Board recommends that joint calls and other transnational actions be funded by the participants and the national funding agencies, but that the Nordic Energy Transport Platform funds the collaboration and networking; meaning coordination, travel, meetings and communications. The national scope is strong in the Nordic countries and the platform has a job to do in facilitating the meeting and the creation of new businesses and research cooperation.

Nordic Energy Transport Platform

A Nordic tool that can realise a single-market area for research and innovation of low carbon transport services

➤ Initial focus on electromobility

EV car sharing concept

EV consumer information

EVs in public transportation

The platform would act as a tool for realising a single-market area for research and innovation of low-carbon transport services in the Nordic region, and serve as a complement to EU cooperation and other international fora. To concretise the focus to more tangible results-oriented objectives, an initial focus of electromobility is proposed with three subsequent topics for Nordic efforts: (1) EV car sharing concept, (2) EV consumer information, and (3) EVs in public transportation. This Nordic platform will coordinate actions for increased market penetration of electromobility within the Nordic countries as a joint Nordic arena. The specific ideas under the three differentiated topics are presented below.

A Nordic electric vehicle car-sharing concept

- The Nordic Electric Avenue (NEA) project has demonstrated a common business concept on the Nordic market for EV car sharing. NEA was active along the axis Copenhagen – Gothenburg – Oslo and their recommendations related to car sharing can be developed further. The standardised and seamless framework and interface of the project have great potential to be extended and developed, enabling integrated access to easy EV short-to-medium-time usage in the Nordic countries.
 - *Concrete focus:* develop a common Nordic EV car-sharing concept.

Better consumer information on electric vehicles

- Drawing from experiences learned from the projects (e.g. RekkEvidde and EVRMAP projects), increased and more accurate consumer information is needed to EV customers. To help spur on the positive developments on the EV side in the Nordic region, the customers must have better information to make decisions on the advantages and disadvantages of acquiring an EV. Furthermore, information to consumers on transportation and goods can be a

beneficial avenue to pursue further in the light of the Nordic Ecolabel (Svanenmärket, *cf.* SAFE project).

- In the driving situation, the disposition of current up-to-date information and the improvement of charging infrastructure is imperative. Better and more harmonised information on Nordic EV charging infrastructure is identified as an important area where further efforts are needed (*cf.* EVRMAP project). The evaluation of current infrastructure and the dissemination of its functions, whereabouts and costs for consumers will become an important tool to bridge information and implementation and utilisation of EVs.
 - *Concrete focus:* (A) information and reachability of EV charging, (B) consumer behaviour and barriers to EV use, (C), business models for EV charging, and (D) Vehicle-to-Infrastructure communication supporting driving behaviour.

Electric vehicles in public transportation

- Based on feedback and policy conclusions from the projects, the next logical step in the electromobility arena would be to enhance the applicability and presence of EVs in the transport chain, including public transport services. The usage of electric drivetrains in public transport is only starting, but there is a huge potential, e.g. for electric busses and ferries. Joint Nordic research and piloting will create a basis to scale up and a more encompassing Nordic approach can achieve a higher cost-effectiveness and increased international linkages.
 - *Concrete focus:* Cooperation on electric vehicles in public transportation, for example busses and ferries, with joint procurements and project scale-ups.

Nordic cooperation on energy and transport has shown its merits and benefit, and future collaboration endeavours have been identified as needed, meaningful and beneficial. The formulation of such future cooperation is not set in stone however, and resource limitations, thematic focus and political priorities will set the agenda for what the future will look like. Nevertheless, the Nordic Council of Ministers has, through the adoption by the Nordic Ministers for Energy, formulated a Nordic action

programme for co-operation in energy policy 2014–2017,¹⁵ where transport, and specifically electric vehicles, is mentioned as a prioritised future cooperation area in the Nordic region. This defines the support for following up on the opportunities created by the Energy and Transport programme, and responds to identifying new areas of cooperation as implied in the original goals of the programme.

The Board of the Energy and Transport programme recognises the value of Nordic cooperation established during the Energy and Transport programme, and strongly supports a continuation of Nordic energy and transport cooperation as a Nordic Energy Transport Platform. The continuation of Nordic cooperation through a Nordic Energy Transport Platform is seen as the next logical step that can bring the most added value to future Nordic collaboration while building further on the knowledge and experiences already gathered. By doing this, we can ensure proper anchoring of continuous communication of the programme's results to international arenas and spread the example of the Nordic region on sustainable transportation and energy technologies.

¹⁵ See www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-business-energy-regional-policy-mr-ner/strategy/nordic-action-programme-for-co-operation-in-energy-policy-2014-2017/view pp. 12-13.

5. Outcome and the way forward



5.1 Conclusions

The Energy and Transport programme has shown that cooperation on sustainable transportation issues is a meaningful, beneficial and logical Nordic venture. By avoiding duplication and fragmentation of research and strengthening already ongoing collaborative actions in the region, the programme has created a common ground for national priorities to be scaled up and developed further in a larger context. The results of the programme depicts a range of project ideas, research and solutions, as well as a common Nordic framework to tackle global challenges such as climate change mitigation. Project success stories like Range & Performance of Electric Vehicles in Nordic Driving Conditions (RekkEVIDde), Nordic Electric Avenue (NEA), Alcohol [Spirits] and Ethers as Marine Fuel (SPIRETH), as well as others, have taken a Nordic lead and approach on testing and developing new energy technology solutions for

sustainable transport. Electrical vehicles (EVs) are continuing to show promising innovation results, and building further on the current project results can be highly beneficial to increase EV market penetration and create a better awareness and understanding of EV usage. The success of EVs in the Nordic region, and that of carbon-free transport, can be promoted by common actions throughout the five Nordic countries.

Nordic added value from the programme has stemmed from new cross-border partnerships, novel project ideas and resource effectiveness when combining efforts of leading experts in the region. The Nordic countries are, though having a lot in common, different in many aspects, and with that comes differences in expertise, energy systems and institutional setups. However, it is when combining these differences to achieve mutually beneficial results that the Nordic region can really become a leading region of new, innovative technology developments in sustainable transportation. This has also been evident when taking into account the international applicability of the results of the programme, which can lead to new exports, good examples and a more robust and innovation-friendly international policy framework.

The key message from the projects has been the positive response to the programme, and the added value for the individual project partners and institutions. Further cooperation in the field is needed and desired by all the involved parties. This displays the significant impact the programme has had within the energy and transport sector cooperation, and demonstrates the necessity to continue with Nordic cooperation. The Board of the Energy and Transport programme recommends that a *Nordic Energy Transport Platform* is established to act as a tool that can realise a single-market area for research and innovation of low carbon transport services. The initial focus of the platform would be on electromobility with three distinct topics – (1) EV car sharing concept, (2) EV consumer information, and (3) EVs in public transportation.

The focus on electromobility is based particularly on the current rapid developments both at the time of the start of the Energy and Transport programme and during the programme's course. There is a strong push from the industry, where the activity levels in the different Nordic countries are on a continuous rise. However, there is an apparent need for additional knowledge, and awareness of EV usage, where the user knowledge might not keep up with the technical developments. The Nordic countries have well-developed and suitable electricity systems for EV utilisation, and the integration of EVs in the system will be ever so important in the future as regards to smart electricity grids and flexible electricity demand. This makes the electromobility focus a coherent

choice where the Nordic region can continue on the forefront of developments for sustainable and innovative transportation.

5.2 Policy recommendations

The programme has spanned a wide variety of topics in different areas and at different technology readiness levels, but can still find a consensus on what the next steps should be. In order to realise a transition from carbon-fuelled transportation to fossil-free and sustainable transportation in the future, the public involvement needs to be strengthened on all responsible levels (municipal, national and regional). This transformation requires multiple actors to be involved, which creates complexities in the system. The Nordic governments need to apply sufficient cooperation and coordination on mutual issues where the benefits are evident and the alternatives limited. There is a strong push from the industry, and common goals are needed and joint efforts are required. Based on the results of the projects and the programme, and with regards to the positive response on the need and desire of future cooperation in the field, the Energy and Transport Board recommends that:

- The Nordic Council of Ministers seize the momentum and build on the progress made in the Energy and Transport programme, by supporting further efforts on Nordic cooperation in sustainable transportation.
- Public involvement is strengthened throughout the value-chain in the Nordic region in order to meet the challenges and provide a comprehensive approach on mutually beneficial cooperation, procurement, involvement and project scale-up.
- A Nordic Energy Transport Platform is established, with an initial focus on electromobility, to act as a tool that can realise a single-market area for research and innovation of low carbon transport services.

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Website

All Energy and Transport final project reports are available at www.energyandtransport.net

The mapping of Nordic initiatives and regulations can be found at www.energyandtransport-efforts.net

Sammanfattning

Energi och Transport, ett program under Nordiska ministerrådets Globaliseringsinitiativ, har haft som mål att bidra till att göra Norden till en ledande region i Europa för utveckling, demonstration och användning av nya, hållbara energiteknologier inom transportområdet. Huvudaktiviteten i programmet har varit att finansiera nordiska gränsöverskridande projekt för att realisera minskade koldioxidutsläpp, ökad energieffektivitet och förbättrad energisystem-integration inom transportsektorn. En första utlysning för projekt gjordes 2010 med inriktning på elektrisk transport och en andra utlysning 2011 inriktad på hållbar godstransport. Totalt blev tolv projekt finansierade av programmet med 19 mn NOK (total budget för projekten var 59 mn NOK).

Energi och Transport-programmets resultat har visat att samarbete kring hållbara transportlösningar i Norden är både nyttigt och logiskt. Genom att undvika duplicering och fragmentering av forskning, och samtidigt förstärka redan pågående forskningssamarbeten, har programmet bidragit till att skapat en gemensam grund för nationella prioriteringar att utvecklas vidare från. Resultaten visar på en mängd olika projektidéer, forskningsinriktningar och lösningar. Projekt-succéhistorier såsom *Range & Performance of Electric Vehicles in Nordic Driving Conditions* (RekkE-Vidde), *Nordic Electric Avenue* (NEA) and *Alcohol [Spirits] and Ethers as Marine Fuel* (SPIRETH), samt andra, har tagit täten i Norden för tester och utveckling av nya energitekniska lösningar för hållbara transporter, både i Norden och internationellt.

Nordisk nytta från programmet har åstadkommit av gränsöverskridande projekt, nya projektidéer och genom resurseffektivisering när aktörer i regionen samarbetat. De nordiska länderna är, trots många likheter, olika varandra i flera aspekter där expertisen finns inom skilda områden. Det är när dessa olikheter kombineras som ömsesidig nytta bäst åstadkoms för att realisera målet om Norden som en ledande region inom innovativa energiteknologiska lösningar och hållbara transportsystem.

Ett viktigt budskap från projektdeltagarna har varit den positiva respons som programmet fått, samt intresset för fortsatt nordiskt samarbete inom transportområdet. Styrgruppen för Energi och Transport-programmet vill således rekommendera att en *Nordic Energy Transport Platform* upprättas för att agera som ett verktyg för att realisera en inre

nordisk marknad för forskning och innovation av koldioxidsnåla transporttjänster. Denna plattform rekommenderas ha en inriktning på elektromobilitet och tre specifika teman – (1) *EV car sharing concept*, (2) *EV consumer information*, och (3) *EVs in public transportation*. De nordiska länderna delar en välutvecklad elmarknad där integreringen av elfordon i framtiden kommer vara viktig för att underlätta flexibelt resursutnyttjande. Detta, tillsammans med intresset för och utvecklingen inom området, gör elektromobilitet till den mest fördelaktiga inriktningen för ett fortsatt samarbete. Styrgruppen för Energi och Transportprogrammet rekommenderar således att:

- Nordiska ministerrådet tar fasta på den utveckling som skett inom programmet och tillgodoser intressena för fortsatt samarbete inom området på ett lämpligt sätt.
- Offentliga aktörer tar ett större ansvar inom alla delar av värdekedjan i Norden för att tillhandahålla en övergripande strategi för framtida hållbara transportlösningar.
- En *Nordic Energy Transport Platform* etableras, med initialt fokus på elektromobilitet, som agerar som ett verktyg för att realisera en inre nordisk marknad för forskning och innovation av koldioxidsnåla transporttjänster.

Appendix

Key communication activities of the Energy and Transport programme

Strategy Workshops in each Nordic country, March 2010

One workshop in each of the Nordic countries with representatives of a broad selection of national stakeholders. The goal was to collect input from the national energy and transport sectors to steer the programme development and ensure proper anchoring in national programmes and initiatives.

Nordic Mapping on initiatives and regulations for sustainable transportation, 2010

An initiative to create a sound foundation for the Energy and Transport programme and to create a comprehensive picture of the Nordic countries strengths and priorities in the area. The mapping was made by Sweco after a public procurement process in April 2010.

Energy and Transport programme website

Continuous updates and main news outlet from the programme. Descriptions of each project, with final project reports and other related media. Additional information of the entire programme, the Board, Secretariat and project support.

Kick-off meeting for Electric Transportation Portfolio, 1st April 2011, Oslo, Norway

Each project was invited to present their ideas and to frame all projects as part of the wider Energy and Transport programme. Networking, discussions and project support was established.

Energy and Transport Board Workshop, 6th February 2012, Oslo, Norway

Board workshop with the programme reference group. Presentation by Energidata on future and possible Nordic energy and transport cooperation.

Electric Vehicle Symposium 26, 6th–9th May 2012, Los Angeles, CA, United States

Presentation of projects' preliminary results and the Nordic region's work on energy and transport at the world's largest electromobility fair.

Kick-off meeting for Sustainable Freight Transportation Portfolio, 17th October 2012, Helsingborg, Sweden

Each project was invited to present their ideas and to frame all projects as part of the wider Energy and Transport programme. Networking, discussions and project support was established.

Mid-way Energy and Transport programme conference, 17th October 2012, Helsingborg, Sweden

All projects from both portfolios were invited to participate in a mid-way conference to present initial project results, network, discuss future project plans and collaborate on new ideas.

Energy and Transport Board Workshop, 18th October 2012, Helsingborg, Sweden

Board workshop on the preliminary project results from the mid-way conference.

Energy and Transport Board Workshop, 13th March 2013, Helsinki, Finland

Board workshop on potential policy recommendations from the programme.

Regional Power for Clean Transport conference, 30th–31st October 2013, Oslo, Norway

Keynote presentation at the conference on the Energy and Transport programme's preliminary results and Nordic efforts and cooperation in the field.

Electric Vehicle Symposium 27, 17th–20th November 2013, Barcelona, Spain

Participation and presentations at the world's largest electromobility fair. Part of the Norwegian stand at the exhibition.

**Final Energy and Transport programme conference, 6th
February 2014, Stockholm, Sweden**

The projects' final results were presented to all the projects and invited key stakeholders. Presentations by leading industry experts, as well as panel and participant discussions on the possibilities and interests for future Nordic cooperation within energy and transport.



Key results and recommendations

The Energy and Transport programme's overall objective was to contribute to making the Nordic region a leading region in Europe for developing, demonstrating and using new, sustainable energy technologies for transportation.

The main activity of the programme has been to fund Nordic cross-border projects covering sustainable transportation aspects. Calls for projects were released in 2010 (Electric Transportation) and in 2011 (Sustainable Freight Transportation).

The programme's results point to a successful outcome with novel project ideas, new Nordic partnerships and combined research efforts. The Nordic countries are, though having a lot in common, different in many aspects. It is when combining these differences to achieve mutually beneficial results that the Nordic region can really become a leading region of new, innovative technology developments in sustainable transportation

TemaNord 2014:537
ISBN 978-92-893-2792-3
ISBN 978-92-893-2793-0 (EPUB)
ISSN 0908-6692



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