Mapping of alternative fuels in transport

In the North Sea Region

11th June 2020
The members of the North Sea Commission in the North Sea Region have ambitious goals for reducing climate gas emissions in the transport sector. The report provides an overview of the use of alternative fuels in the public transport sector, incentives for the uptake of alternative fuels in and some information on the coverage of charging and filling infrastructure for alternative fuels. The regions have multiple strategies in terms of improving the carbon footprint from transport, depending on the relative strength and weakness of the source of energy in relation to the means of transport.

Biofuels is a first step towards zero emission in the public transport, and typically used for transporting passengers and goods longer distances. Electric buses are growing in importance in cities, and for shorter haul transport in the regions. Hydrogen is used for longer distances, and heavier vehicles, for example trains, ferries and buses. Liquefied natural gas (LNG) is mainly used for ferries. The energy systems for refuelling and charging is gradually being expanded in the North Sea Region to cater for the uptake of alternative fuels in transport.
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Executive summary

This report is giving an overview of the use of alternative fuels in public transport in the North Sea region, and the relevant practices on promoting the uptake of alternative fuels in the region. The main finding of the report is that the regions have multiple strategies in reducing climate gas emissions from the public transport sector, ranging from biofuel, electricity, hydrogen and natural gas/ LNG and diesel hybrid.

By "alternative fuels" we understand fuels other than conventional petroleum and diesel, based on renewable or low-carbon sources.

The report is based on information provided by North Sea Commission (NSC) member regions. All regions which have participated in this survey have adopted strategic goals for cutting climate gas emissions and facilitating the uptake of alternative fuels in the public transport sector. All these regions have defined policy goals and objectives for moving towards low or zero emission public transport in between 2023 and 2035. For example, Rogaland County Council (NO) aims at zero emission public transport in 2022 for the Stavanger region; Central Denmark Region aims at 50% renewables in 2025; Northern Netherlands in 2030 for the buses and 2035 for the trains.

The member regions have varied strategies to reach low- or zero emission goals for the transport sector and reduce oil dependency. The regions report uses of biofuels (especially HVO), biogas, electricity, hydrogen, hydrogen - natural gas, and hybrid electric. Adequate coverage of infrastructure for refuelling and charging is one of the obstacles for the use of alternative fuels in transport.

The use of biofuel is growing in the public bus transport, especially for longer distances. Several regions have a large part of their total bus fleet running on biofuels. Region Västra Götaland (SE) has 90 per cent of the route production on alternative fuels (biofuels HVO and biogas), and the Vestfold and Telemark region (NO), has some 40 percent of the route production currently on biogas.

For the cities and shorter distances in the regions outside of the city electricity seems to be the way to go to zero emission in public transport. Almost every region has already part of their bus fleet on batteries. Groningen and Drenthe (NL) will have 155 battery electric buses starting by the end of 2019 (50% of the total bus fleet), and former ¹Hordaland County Council (NO) already has 80 electric buses and 100 will be running in 2020.

Electricity is also prevalent in other forms of public transport: Several regions have electric light rail systems. The light rail system in Bergen is currently being expanded and will constitute the backbone of the public transport system in the second largest city of Norway (Vestland region). More and Romsdal County (NO) are introducing 16 electric ferries in 10 ferry connections in the coming four years from 2020. There are initiatives to provide charging infrastructure on shore for ships. F. ex. the Port of Kristiansand in Agder (NO) has a shore power facility for cruise ships.

Hydrogen is typically used for longer distances and for larger vehicles/ships, etc. There are several regions using hydrogen for example in bus transport (Aberdeen City (UK), Groningen and Drenthe (NL), and ferry transport (Orkney (UK) and trains (Lower Saxony - DE).

Liquefied natural gas (LNG) is mainly used for ferries. Central Denmark Region (DK), Schleswig-Holstein (DE) and in More and Romsdal County (NO) a couple of ferries run on LNG. Hordaland (NO) also has

¹ Hordaland was merged with Sogn og Fjordane into Vestland County as of 01.01.2020, but the quoted figures are only concerning Hordaland
100 buses on LNG. Vestland (NO) has 100 buses on LNG that will be replaced with biogas buses in the end of 2020.

Almost every region has a big and growing number of public charging and fueling stations for alternative fuels. Västra Götaland (SE), Groningen (NL), Schleswig-Holstein (DE), Aberdeen (UK) and Hordaland (NO) have at least one hydrogen fueling station. Several regions have dedicated infrastructure for alternative fuels for the public transport. Västra Götaland (SE) has its own dedicated infrastructure for HVO and biogas, Vestfold-Telemark and South Denmark region have HVO and biogas stations as well.

There are various incentives and schemes supporting the use of alternative fuels in the transport systems in the North Sea region. Such schemes are ranging from tax/ duty- exemptions or reductions, interest free loans for purchasing low- or zero emission vehicles, access to free parking or public transport lanes, or grants for pilots testing vehicles on alternative fuels.

1. Introduction

1.1 Background

On 4 March 2015 the Executive Committee of the North Sea Commission (NSC) requested the transport group to make an overview of projects on alternative fuels for public transport in the member regions. This report is intended to serve as an observatory for relevant practices on promoting alternative fuels in public transport in the NSC member regions and as a reference for the development of future EU projects. The report may also be used as a basis for future policy resolutions in the NSC.

This document provides an overview of the following themes relating to the use of alternative fuels:

• The use of alternative fuels in public transport and service vehicles in own organisations and services
• Any incentives or schemes applying for alternatively fueled vehicles in the regions, including exemption from or reduced parking fees/regulations, exemption from or reduced congestion charges/toll fares, and access to public transport lanes etc.
• The availability of filling and charging stations & related facilities and infrastructure

This report is based on information provided by the member regions. It is a dynamic document that has been updated continuously over the period of a couple of years. The member regions covered by the report are organised per country:

• DE (Germany): the city of Bremen, the State of Schleswig-Holstein, the State of Lower Saxony
• DK (Denmark): Central Demark region, North Denmark region, South Denmark region
• NL (the Netherlands): Groningen, Friesland and Drenthe region, the city of Groningen
• NO (Norway): Agder region, Møre og Romsdal region, Vestfold-Telemark region, Vestland region, Rogaland region
• SE (Sweden): Region Västra Götaland, Region Örebro, Region Halland
• UK: Aberdeenshire Council, the City of Aberdeen, Orkney Islands Council

The findings for each region are presented per country and in alphabetical order.
The report cannot be considered to give a complete overview of the situation in the member regions of the North Sea Commission as the subject matter of alternative fuels in the transport sector is evolving quickly. Moreover, not all member regions have submitted feedback in the survey.

1.2 Definitions and specifications

By "alternative fuel" we understand fuels other than conventional petroleum and diesel, based on renewable or low-carbon sources such as bio-energy, electricity, natural gas or hydrogen, or any combination thereof. Vehicles with hybrid fuel systems (gas-hydrogen, diesel-bio etc.) also count as "alternative fuel" in this survey.

"Public transport" is in the context of this survey including all transport modes, e.g. buses, taxis, trains, and ferries, and both scheduled and demand-responsive services, e.g. "on-call services".

2. Strategies, objectives and measures to stimulate the uptake of alternative fuels in the transport sector

The Free Hanseatic City of Bremen (DE) adopted a Sustainable Urban Mobility Plan (SUMP) in 2014 which intends to actively promote ecomobility, to improve the quality of life in the city by optimising the transport system and reducing the negative impacts of transport such as safety risks, pollution and noise. The plan has a dedicated measure for electrical mobility in local public transport and intermodal interfaces.

Bremen’s SUMP has set clear, quantified objectives. Its 2020 objectives are the following: 1) 20-25 % increase in bicycle traffic; 2) 15-20 % increase in public transport (bus and tramway); 3) 50 % increase in rail transport (suburban railway); 4) 20 000 car-sharing users.

The use of alternative fuels in public transport in Schleswig-Holstein (DE) depends on who runs and owns the vehicle fleet. The land government is not responsible for public transport.

The state of Lower Saxony has been providing financial support for local public transport companies in the procurement of buses since 2015. As part of a funding program, buses with alternative fuels are being promoted more extensively than buses with diesel energy.

In addition, a guideline for the promotion of vehicles with CO₂-free or CO₂-economical drive systems in public transport as part of the EU EFRE program will be valid this year. This provides for a high funding rate of up to 80% by increasing state funds. The aim of this is to increasingly use buses and other vehicles with CO₂-free or CO₂-economical drive systems in regular public transport in order to achieve an increased use of low-carbon mobility offers as well as with alternative drives for moving means of transport.

In the Central Denmark Region (DK) a partnership on strategic energy planning has been established between the Region, municipalities, energy companies, universities, etc. A strategy and a plan of action, towards 50% renewable energy by 2025 (regional target) and longer term 100% (national target) of the total energy consumption in all sectors, have been established. In the field of biogas the strategy is that 75% of the region’s manure, along with an equivalent quantity of other biomass, will be used to produce biogas, and the biogas will, to a significant extent, be upgraded to the quality levels of natural gas and will be fed to the natural gas grid, from which the gas may be used for heavy transportation through strategically positioned gas service stations.

The provinces of Groningen, Friesland and Drenthe (NL) have ambitious goals as regards renewable fuels for all vehicles operated by the local governments. This concerns all kind of vehicles like cars,
trucks, buses and boats, and both biogas and electricity. The three provinces also signed an agreement with the other provinces and the national government with the goal to have all buses to run on zero emission fuels ultimately in 2030. The province of Groningen also signed a similar agreement for the trains with the same goal only in this case ultimately in 2035. Furthermore, a Letter of Intent has been signed between the region Northern Netherlands and the national government about the call to have 100% zero emission mobility in 2035.

The administrative company for public transport in the Agder region (NO), AKT, is continuously upgrading the bus fleet to more environmentally-friendly buses. Last year, in the Kristiansand area, 139 diesel buses have been replaced by 153 buses running on green electricity, bio-diesel, or on a combination of electricity and bio-diesel. See more details under the relevant sub-sections below. The strategy for both AKT and the county is to gradually electrify the public transport during the next decade, where city transport will be a first priority.

The Vestfold and Telemark region (NO) has adopted goals and strategies to replace fossil fuels in the public transport, mainly by introduction of biogas from organic waste. In the former Vestfold county, the Council decided in 2015 that at least 70 per cent of the rout production of the bus transport should be based on biogas. There are a number of ferries in the public transport system, out of which one – the Breivik ferry in the Greenland area- will running on electricity as of beginning of 2021. There is an initiative to consider the possibilities for introducing electric buses on short-haul bus routes.

Rogaland County Council (NO) is aiming for a 100 percent emission-free public transport in the Stavanger region (comprising about 2/3 of the population in Rogaland) by 2023. For the new Busway in the Stavanger region the aim is for all buses to run their electric upon the opening in 2021/2023. There was established congestion charges in the Stavanger area from 1st of October 2018. It has led to less traffic, and new records for the number of bus passengers every month thereafter, and also new records in terms of the number of registered bicyclists. The congestion charges are being used to fund a continued building of the “Bussveien” or in English “busway”, which is a bus rapid trasit (BRT) system.

There is currently a pilot project with five battery busses that has been running for almost three years. Together with NCE (National Centre of Excellence) Maritime CleanTechRogaland County Council have been awarded NOK 110 mill from Horizon2020 to develop an electrical fast passenger ferry which will be used in the vicinity of Stavanger. The work with the electric fast passenger boat has started. The project with the world’s first Hydrogen ferry by 2021 is proceeding well and the ferry is now being built.

The Vestland County Council (NO) has adopted a 40% reduction in CO2 gas emissions in public transport before 2030. The fast ferries account for a large share of the emissions, and it is decided that the region should require zero- emission technology for the largest fast ferries. The consumption of diesel will be reduced from 8 million liters to 1 million liters per year.

The public transport company in Region Västra Götaland (SE) has defined requirements for renewable fuels in the procurement of public transport services and vehicles as a way of reducing the use of fossil fuels. The public transport corporation (Västrafrik), responsible for public transport in Region Västra Götaland (SE), has defined requirements for renewable fuels in the procurement of local public transport services and vehicles as a way of reducing the use of fossil fuels in the region. The goal for 2025 is that at least 95% of the public transport shall operate on renewable fuels, which represents a reduction of 25% in energy consumption per person/km compared to 2010. Furthermore, the region aims to reduce the emission of CO2 and particles by at least 60% per person/km compared to 2009.
In Sweden, it has been decided that greenhouse gas emissions from domestic transport (excluding aviation) by year 2030 should be at least 70 percent lower than the 2010 level. This target also applies in for Region Örebro (SE) and is expressed in the region’s strategy for energy and climate which says that by 2030, transports in the region will be fossil independent. The goal of fossil-free public transport by 2020 has already been achieved. Although it still contributes to public transport in the region it will continue to be a basic demand for renewable fuels. In the long term it will be a good support for the establishment of prioritized public charging and gas infrastructure Today, public transport in Örebro Region consists of around 300 buses, of which about half are running on biogas and the rest on biofuels HVO/FAME. A total of 25% of the fuel for transport in the region is renewable, compared to the rest of Sweden where the total share amounts to 21.6%.

In Halland county (SE) the transports that are procured the vehicles have demands to comply with EURO 6 and a minimum of 50 % of the fuel must be fossil free. From 2020 and the coming ten years, 25 % of the public transport in the cities, operated by busses, will be run by battery electric vehicles, and the rest of the busses in the region will be fossil free, which in this case means HVO. The trains run on mostly fossil free electricity mainly consisting of hydro, nuclear and wind power.

In Aberdeen (UK) the City Council’s Local Transport Strategy (2016-21) lists the uptake of ultra-low and low emission vehicles as a key city priority. This supports the Scottish Government’s commitment to have a complete decarbonisation of the road transport sector by 2050. Expansion of the electric vehicle network is integral to this plan. As well as the Local Transport Strategy, Aberdeen City Council also has a Strategy and Action Plan for Hydrogen (2015-2025). The strategy outlines the actions required in the short, medium and long term to secure investment for further vehicle deployments and refuelling infrastructure.

Aberdeen City Council is also working towards delivery of a Low Emission Zone (LEZ) in the city centre. Phase 1 will commence in late 2020 and will seek to reduce bus emissions. Options for Phase 2 (which will encompass multiple vehicle types) are still subject to appraisal and public consultation, but we anticipate identifying a preferred option in late 2020/early 2021.

The Council has also recently commissioned consultants to undertake an EV Framework which will guide our plans for the next 5-10 years.

We are also revising our strategy towards car parking in 2020 and it is hoped that these projects – EV Framework, LEZ and revised car parking policies – contribute to encouraging a further uptake of alternative clean fuels amongst residents and businesses.

Aberdeenshire Council are updating their Local Transport Strategy (LTS) to align with the both the revised Scottish National Transport Strategy and the developing Regional Transport Strategy which has a timeframe to 2040. The new LTS will include input from this survey.

3. Use of alternative fuel in public transport

All regions in the survey are currently applying or planning to take up alternative fuels in their public transport services. This concerns a variety of different fuels or combinations thereof, such as bio-fuels, electricity, hydrogen, natural gas/LNG and diesel hybrids. The responses are covering different forms of public transport like buses, trams/light rail, rail and ferries.
3.1 Liquid biofuels and biogas

Since 2013, 14 buses covering regional routes in Central Denmark Region (DK), have been fueled by diesel with 25% biodiesel added. The EU standard requirement is 7%. The specific biodiesel used is 2nd generation and is produced using carcasses and waste from abattoirs.

Central Denmark Region has entered into a partnership with 14 of the region’s municipalities, Midttrafik (the regional public transport company) and HMN (the regional natural gas company) to distribute (certified) biogas for buses and heavy transportation. Despite a widespread natural gas grid, the lack of refuelling options for gas-driven vehicles in Denmark, is an obstacle in the distribution of biogas for transport. Thus the partnership will investigate, whether the public bus transport and other forms of public transport, may provide opportunities for widening the distribution of refuelling options.

So far, the partnership has mapped the potential in each municipality for the conversion of busses and heavy vehicles to CO2 neutral biogas operations. This includes the regional bus routes which operate across municipality boundaries. The mapping incorporates localisation of the existing fleet, as well as the options of strategically-situated refuelling stations in relation to the distribution of the natural gas grid.

As part of a larger climate focus, several of Central Denmark Region’s municipalities aim to reduce the climate liability of public bus transport, as well as other forms of transport. An example is by converting conventional bus operations to biogas operations. The municipalities of Holstebro, Skive and Silkeborg have all made the conversion, or are in the process of doing so.

In Aarhus, the largest municipality of Central Denmark Region, the plan is to offer the city buses, which are suitably located in correlation to the existing natural gas grid, to operate on (bio)gas. The time-frame is 2019/2020.

*Illustration: Biogas bus in the Vestfold and Telemark region (NO). Source: VKT*
In the recent bus tender, the North Denmark Region (DK) has converted 13 regional buses to biogas. The 13 buses will be operational at the end of 2020. Over the next four years all of the routes in the North Denmark region have been through tender. It is expected that all buses will be converted to biogas or a “greener” technology.

City buses in Municipality of Fredericia (11 of them) in South Denmark Region (DK) are running on biogas. In the Municipality of Sønderborg 44 biogas-busses have been in operation since June 2017.

In 2008 a bus fleet based on biogas started to operate in Groningen, Friesland and Drenthe (NL). After two years the new concession started, and the biogas buses are not being used anymore. Starting from the new bus concession by the end of 2019 half of the total bus fleet is running on zero emission fuels (batteries and hydrogen) and the other half (around 170) will run on biodiesel.

Starting from the end of 2020, 18 trains (of the 70 in total) will run on HVO (biodiesel) between the capital cities of Groningen and Leeuwarden. All 70 trains will save their breaking energy from that moment as well. Arriva won the concession for all the regional lines in Groningen and Friesland starting from December 2020 and ending in 2035. By that time Groningen is aiming to have all trains on zero emission fuels. Groningen was also testing a hydrogen train in March 2020.

In the City of Kristiansand in Agder region (NO), 74 buses are running on Euro 6 Hybrid bio-diesel. This fuel is based on raps and is reducing the CO2 emissions with appr. 60% compared to a conventional Euro VI diesel bus (“well-to-wheel”).

In 2020 approximately 380 out of 1000 buses in Vestland (NO) is operating on biodiesel. A plant which produces biogas from sludge from sewage has been built in the Bergen area. From December 2020 about 130 buses will use biogas as fuel.

The Vestfold and Telemark region (NO) has adopted goals on replacing fossil fuels with biogas in the public bus transport. In autumn 2019 some 40 percent of the route production of the bus transport in the region is based on bio-gas. The biogas is produced locally from organic waste. The introduction of biogas has so far reduced CO2-emissions from public bus transport by 29 percent. The remaining bus transport, which is not running on biogas, are required to run on certified biofuel diesel.

Rogaland (NO) has 51 gas buses. The buses are running on natural gas and an increasing share of locally produced biogas. There is currently a pilot project with five electrical buses in the Stavanger-region. The city buses in Haugesund will get electrical buses from the summer 2020.

In Västra Götaland (SE), the proportion of renewable fuel in public buses (about 2000 buses) represents 96% and are operated by the regional public transport corporation Västtrafik. The region is working with three different renewable fuels - biodiesel (HVO), biogas and electrification. During 2018, 320 GWh biogas was produced at 45 production plants in Västra Götaland and the same year, 229 GWh of vehicle gas was delivered. In 2019, the region had 50 public fuel stations for vehicle gas.

In Sweden there is unique conditions for producing biofuels from waste, agriculture and forestry. This is the main reason why biogas is the only renewable fuel for transports produced in Region Örebro (SE). There is a total of 14 biogas plants in the region. In 2016, the biogas plants in Örebro produced a total of 113 GWh. This corresponds to just over five per cent of total biogas production in Sweden, which amounts to about 2 TWh, distributed over a total of 279 biogas plants. Almost half of the biogas produced in Region Örebro is used within the region and the remaining quantities are delivered to other parts of the country.
In the county of Halland (SE) 25% of the public transport in the cities, operated by busses, will be run by battery electric vehicles, and the rest of the busses in the region will be fossil free, which in this case means HVO. None of the bus operators will be using biogas at this point.

3.2 Electricity

A large number of electric cars is integrated in the vehicle fleet of the police in the State of Lower Saxony as part of the project “lautlos&einsatzbereit” (“silent &ready for action”) 2016 - 2019: Integrated Planning and Control of Fleet, Energy and Charging Infrastructure.

Police fleets are characterized by a large number of different vehicle types, a high number of vehicles and a high visibility of their vehicles. A sustainable and environmentally-friendly operation of these fleets by using new drivetrain technologies is due to their exemplary function in society of particular relevance. Therefore, the police in Lower Saxony takes a pioneering role in integrating battery-electric (BEV) as well as plug-in hybrid vehicles (PHEV) into their fleets. The use of BEV’s and PHEV’s, compared to conventionally powered vehicles, is accompanied by long charging times, limited driving range and availability of the vehicles. Moreover, an energy and charging infrastructure is required for the operation of the alternatively-powered vehicles. With the planned, combined use of BEV and PHEV in Services and Patrol Duty, the police is facing the challenge of ensuring the availability of their vehicles in a continuous 24/7 service. This results in a multitude of dependencies between the fleet, energy and charging infrastructure. Furthermore, the complexity in planning and controlling the fleet is multiplied.

In the project "lautlos&einsatzbereit", 50 BEV’s and PHEV’s will be integrated into the fleet of the police of Lower Saxony. The vehicles will be tested and evaluated in areas of application of services and patrol duty, criminal investigation services as well as fiscal runs. The operation of the vehicles is accompanied by scientific research that focuses on the collection of the mobility requirements and charging demands in all fields of operation. Based on this, an integrated system for fleet planning and control as well as charging management will be developed, which fulfils the special requirements of police fleets. The challenge of the new planning and management system is to meet the extreme
requirements of the police, such as unpredictable time and range of deployment, as well as the need for nearly 24/7 availability, especially in the field of everyday patrol service.

The results of the project will be summarized in a guideline that serves the integrated planning as well as the ecological and economical operation of vehicle fleets under extreme conditions. The guideline can assist decision-makers concerning planning, procurement and operation of electric vehicle fleets, especially under extreme conditions (e.g. additional police fleets, but also fire fighters or rescue services).

In the South Denmark region (DK) an electric ferry started to operate in 2019 between the island Ærø (Søby) and respectively Funen (Faaborg) and the island Als (Fynshav). The ferry will have an operation range of 22 nautic miles. Financed primarily from Horizon 2020 (~15 mio. Euro) and Ærø Municipality (~13 mio. Euro).

In Groningen (NL) 10 electric buses (opportunity charging) are driving between Groningen and the village of Zuidhorn and electric buses (overnight charging) are also driving between Groningen and Groningen Airport Eelde in Drenthe. As of the end of 2019 all of the buses in the city of Groningen are zero emission and several regional buses will be as well, and a total of 155 buses will be electric. The goal is that in 2025 all new buses in the rest of Groningen and Drenthe region is zero emission as well and ultimately in 2030 all buses in Groningen and Drenthe will be zero emission. Until that time all remaining buses (around 170) that are not zero emission are already running on biodiesel starting the end of 2019.

Vestland County Council (NO) runs one light rail line from the city center to the airport. The construction work of line number 2 from the city center passing Haukeland University Hospital to Fyllingsdalen (about 10 km) started up in spring 2018 and is supposed to be finished in 2021/22. A new line to the northern part of the city (Åsane) are planned. The light rail system is supposed to be the core of the public transport system in Bergen.

Bergen has a 7 km long trolley line from the city center passing Haukeland University Hospital. The line will be extended through the city center to Laksevåg in the western part of the city. Through the city center, the line will go on batteries, charged up by the contact wire. The line is supposed to open in December 2020.

The Council has concluded an agreement with and received support from the Norwegian public energy agency ENOVA to electrify buses in Bergen. In the end of 2020 112 buses will run on electricity.

New contracts for ferries started up in 2019 and 2020. Hybrid-electric ferries will run all the 17 ferry connections in old Hordaland council. The emission of CO2 is supposed to be reduced with 86 pct. and the energy consumption are supposed to be reduced with 58 pct. In the northern part of Vestland 2 small ferries runs on electricity and most likely the other ferries will be electrified when new contracts start in 2023/2025.

Most of the fastferries from Sogn og Fjordane to Bergen and locally in Sogn og Fjordane are going to be electrified in 2022 – 2024. The largest fastferries with room for 290/190 passengers runs a one way distance of 250 km with a speed of 32 knots. The emission of CO2 is supposed to be reduced with 23 000 ton (85 %).
Møre and Romsdal County (NO) has 24 ferry connections and are in the process of introducing electric ferries or low-emission ferries in 14 of these connections, starting with the connections which are responsible for the biggest emissions. The 24 connections in Møre og Romsdal will have 38 vessels in total. 27 vessels will be low/zero emission. Introduction of electric ferries in Møre and Romsdal county (NO) will reduce greenhouse gas emissions of more than 40 000 ton CO2-equivalents per year, an estimated reduction of about 80 percent. The contracts have incentives for further reductions. Electricity is cheaper than marine gasoil (MGO) which is type of diesel fuel, in Norway, so operators will try to reduce use of MGO in favor of electricity.

The Kirkwall Airport Service in Orkney (UK), a subsidised public bus route, will be served using a fully electric bus from this summer.

The bus fleet in Bremen (DE) is currently running on the cleanest diesel. The public transport company BSAG is currently performing tests on electrical buses, and since 2016 all new or replacement vehicles are operating by electrical sources.

In Aarhus, the largest municipality of Central Denmark Region (DK), the plan is to operate 2-3 electric busses full time in order to gather operating experience over a multi-annual period.

From 1 July 2018, five fully-electric buses were introduced in regular operations in Kristiansand in Agder (NO). These buses are powered by guaranteed 100% green electricity, and apply electrical heating – not diesel-based heating inside. 3 electric buses will operate city lines in Arendal, starting summer 2020. These buses will replace 2-3 fossil fuel buses. Also, the city ferries in Arendal will, according to plan, be replaced by zero emission ferries in the end of 2022.

In cooperation with the Danish company PowerCon, and the local energy company Agder Energi Nett a shore power facility was opened in the port of Kristiansand on 10 September 2018. The facility is integrated in eight 20 foot containers, delivering up to 16 MBA electrical energy according to international standards for high voltage, and is Europe’s largest shore power facility.
The facility is financed by the Horizon-2020 Programme. The shore power system is of such a scale that even the world’s largest cruise ships can connect and shut down the engines while at berth.

The shore power facility has been tested within the cruise season of 2018 at the Port of Kristiansand, and promotes the Port as a front-runner in shore power technology.

The port has made significant investment over the last five years, and this EU-financed project has the potential to be a game changer in the cruise industry. What makes the shore power system unique is the frequency converter that will provide the ships with 50/60 Hz, after the ships demand.

The "Busway2020 project" in Rogaland (NO) will be the cornerstone of the public transport system in the Stavanger area. A vast political majority in the Council has decided that the busway will be operated by electrical buses. The busway will be more than 50 kilometers and will be the longest trolley bus lane in Europe. As a part of the Busway2020 project some lines connecting to the main busway will be running as “slide in” buses. They will be electric buses and charging by the wires while running in the main busway lines. This concept is still being developed.

Rogaland is member of the Smart Cities and Communities Lighthouse Project Triangulum. The project is set to demonstrate, disseminate and replicate solutions for Europe’s future smart communities. Infrastructure solutions, among them electrical vehicles are included in the project. In the ports at Rogaland the work with getting more shoreside electricity is proceeding quite good. They have been getting financial support from the government to have shoreside electricity for larger boats and oil supply boats in ports in the Stavanger area.

In Aberdeen City Co-Wheels operates a Car Club comprising 46 vehicles in 37 locations around the city. All are modern low-emission cars and vans including 21 zero-emission fully electric or hydrogen models and several petrol hybrids.

To support this growing fleet of Electric Vehicles the Council has been working with partners since 2011 to roll out EV charge points across Aberdeen to promote and encourage the further uptake of EVs. The city now boasts a total of 55 units of varying types. We are currently seeking to build on this by opening an EV hub, offering many charging points in a convenient single location with work expected to commence later in 2020.

In Aberdeenshire 76 electric vehicle charger installations have or are being installed by Aberdeenshire Council to provide a publicly accessible capability of 150 charging spaces. The project for roll out and upgrade of electric chargers has recently been as an 65km “electrified corridor” from Aberdeen to the North Coast of Aberdeenshire and is now concentrating on providing facilities at community campuses.

Early generation EV chargers in 6 Aberdeenshire town locations have also now been replaced with more reliable modern units.

In the Vestfold and Telemark region (NO) the first route with an electric bus for was set up in September 2019 in Larvik. One of the public ferry services in the region (in Breivik, in Grenland) will be electric as of beginning of 2021. Sandefjord airport Torp, (of which the county is the majority owner) is working to establish itself as a “climate neutral airport”. It is the first airport in the Nordic countries which is certified ISO 14001 environment management system. One of the goals is to electrify the airport shuttle. The number of passengers of the airport shuttle bus has been growing exponentially in the last years, and exceeded 200 000 in 2019.
Region Västra Götaland (SE) is part of a very interesting project called “RegionEl” which is a regional pilot for electric charging infrastructure for trucks and cars. In 2019, the Västra Götaland has 14,000 public charging points. The constellation RegionEl has four partners at a regional level which is Business Region Gothenburg, Region Västra Götaland, Volvo AB and Volvo Cars. In the area of electrification of heavy transport, a pre-project has the aim to get public financing of around 40 billion EUR from the state. The aims to scale up the project, where the current first pre-project contains 10-15 battery-electric trucks. The current partners in the collaborative pre-project Volvo AB, Region Västra Götaland, the City of Gothenburg and the Swedish Government. RegionEl is part of a permanent world exhibition called Fossil Free Sweden. Fossil Free Sweden was initiated by the Swedish government and have the ambition to make Sweden one of the first fossil-free welfare countries in the world.

There are no official statistics on the amount of electricity used for transport in Region Örebro (SE). There are currently 75 public charging stations for electric vehicles in the region. These include both fast charging (DC) and normal charging (AC).

A distance of 30 km on the E20 highway between Hallsberg and Örebro has been chosen as one of two pilot routes in the expansion of the Swedish national electric road system (E-highway for trucks). The plan is to have the E-road system completed by 2023.

In the Halland county (SE) 25% of the public transport in the cities, operated by busses, will be run by battery electric vehicles. The trains will run on mostly fossil free electricity mainly consisting of hydro, nuclear and wind power. Public charging spots have been installed at almost all estates owned by The Region of Halland, that is hospitals, health centers, county owned schools and the head office. Most public parking spots owned by the municipalities have public charging spots.

3.3 Hydrogen

The State of Lower Saxony (DE) is active in a variety of ways in the field of alternative fuel technologies for vehicles in local public transport. As part of a pilot project, two hydrogen trains with fuel cell technology have been tested in Lower Saxony on the connection from Cuxhaven – Bremerhaven – Bremervörde – Buxtehude since September 2018. The electrically operated Coradia iLint does not get the electricity from the catenary, but from two fuel cells, which convert hydrogen and oxygen into electrical energy. Only water and water steam are removed. Because there are no emissions of greenhouse gases or pollutant particles, the fuel cell hybrid technology offers a climate-friendly alternative for the operation of diesel locomotives on routes that do not have overhead lines. The experience and results of the trial run are currently being evaluated. The experience gained so far is positive for further assignments.

Lower Saxony maintains a pool for local rail passenger trains, which are rented to providers of local transport services. Lower Saxony is purchasing 14 fuel cell vehicles for this pool. These fuel cell vehicles are currently being manufactured and are to be used on the connection from Cuxhaven - Bremerhaven - Bremervörde - Buxtehude from autumn 2021. There they will replace the diesel railcars currently in use.

In 2017 North Denmark region (DK) signed a contract for three Fuel Cell Buses which will be in operation at the beginning of 2020. The buses are produced at Van Hool in Belgium and the Fuel Cells are produced at Ballard in Denmark. The buses will be operating for three years in order to test hydrogen as an alternative fuel to regular diesel, and to support and develop the growing hydrogen
sector in the North Denmark Region. As the range of electric buses are not yet sufficient for regional bus routes, hydrogen, with a promised range of minimum 350 km, has a big potential for longer bus routes. A hydrogen refuelling station provided by Green Hydrogen, has been put into place, where the hydrogen via electrolysis will be produced on site to refuel the buses. The buses are part of the European 3Emotion project. 3Emotion demonstrates the advantages of the fuel cell buses, so that in the future more public transport operators will choose for this type of zero-emission public transport. The buses, which are currently still more expensive than the traditional diesel buses, are co-funded by Europe (FCH-JU) and local partners.

Groningen (NL) has tested two hydrogen buses and by the end of 2019 a scale up with 20 more hydrogen buses took place in Groningen and Drenthe. Since there are still around 170 buses in Groningen and Drenthe that are not fully zero emission after this scale up, Groningen and Drenthe are looking for funding for even more hydrogen fueled buses on their regional lines. Furthermore, Groningen and Friesland are investigating the replacement of the current diesel trains. In March 2020 Groningen did a pilot with a hydrogen train from Alstom and together with Arriva Groningen wants to have zero emission trains in the regular service starting with new trains from 2023. Together with Friesland Groningen is also looking at the option of charging by train stations in combination with a battery train and the option of a completely wired system.

Illustration: Hydrogen train at the Groningen Centralstation, Source: Stefan Verkverk, ProRail

Rogaland (NO) is aiming to get the world's first hydrogen ferry. There is a contest for developing this technology now ongoing. The contract for development was given in the fall of 2018. The aim is to start testing of a new ferry in the fall of 2020 and put into normal operation in 2021.

In Sweden, initiatives are ongoing to introduce hydrogen produced from renewable energy into the production process (so-called green hydrogen). In Region Örebro (SE), developments are being
monitored, but at present, there is no infrastructure for hydrogen in the region. Some initiatives have been started to explore the possibilities of building a hydrogen gas station in the region.

The county of Halland (SE) currently don’t use any hydrogen, and there are no fueling stations for hydrogen in the county, but the possibility of using hydrogen busses in regional traffic is being investigated, as well as replacing some of the vehicles owned by the municipalities and the county.

In Aberdeenshire (UK) there are a number of hydrogen buses running on selected main commuter corridors from Aberdeenshire into Aberdeen City and vice versa, purchased and developed by support from the Interreg North Sea Region Programme and the EU Framework Programme on research – FP7. Aberdeen Council trial operation of a Hydrogen FCRE electric van was successful and Aberdeenshire have now ordered additional vehicles to bring their own operated fleet up to 7hydrogen fuel cell or FCRE electric vehicles.

Aberdeen City (UK) currently has 10 hydrogen buses operating in the city and this will soon increase by 15 – to 25. The City is also in the process of introducing H2 garbage trucks and will look at large scale production of H2 in order to attract H2 trains to the city. The city’s car club, Co-Wheels, has four hydrogen vehicles which can be booked by members of the public. Aberdeen City Council leased a hydrogen vehicle to various taxi companies in the city to trial the technology and to encourage uptake by private operators.

In partnership with Scottish Enterprise and Opportunity North East, the Aberdeen city is undertaking a Business Case for the commercial supply of green hydrogen to catalyse Aberdeen as a ‘Hydrogen Hub’; integrating renewable energy production and hydrogen transport deployment as part of its targets for an Energy Transition and becoming a net zero region. Presentation of options for delivery are being prepared but this includes massively scaling up hydrogen transport deployment in order to increase demand for hydrogen in the region. The Council is therefore working to update the city’s Hydrogen Strategy and a potential regional ‘Hydrogen Operator Partnership Agreement’ with other Aberdeen public sector bodies.

Orkney (UK) has been looking into alternative fuels, with particular focus on ferry services. A project is focusing on the renewable energy produced on the island and whether hydrogen could be stored for use on the ferries etc.

The Region Västra Götaland (SE) has supported two hydrogen gas stations both in Mariestad and Gothenburg. The gas station for hydrogen in Mariestad is called ElectriVillage and is a test- and demonstration spot for sustainable development. The investment in Mariestad with "The world’s first solar-powered hydrogen gas station" is unique in its kind. The municipality’s vehicles can now refuel fossil-free and the only thing that comes out the exhaust pipe of the car is pure water. ElectriVillage is a concept that creates new avenues for social development with business opportunities, jobs and growth. Mariestad collaborate with research institutions from Lund, Uppsala and Chalmers University.
3.4 Hydrogen-Natural gas

There are several transport services in the State of Schleswig-Holstein (DE) which runs on Hydrogen-natural gas:

- A ferry between Helgoland and Cuxhaven (in Lower-Saxony) is run with LNG. Total construction costs of approx. 8 Million €.

- Stena Line runs an LNG ferry between Kiel in Schleswig-Holstein and Gothenburg.

- There are also plans to replace ferries over the Kiel Canal step by step by some which are run with LNG (Kiel Canal is a waterway which belongs to the Federal Republic of Germany).

A new ferry which runs on LNG has been put into operation between Hou and the Isle of Samsø in Central Denmark Region (DK). In the long-term operation of the ferry is intended to be converted to operate on locally produced biogas.

In the Vestland region (NO) there are about 100 buses using liquid natural gas (LNG) in the start of 2020. All these buses will be replaced with biogas buses in the end of 2020.

3.5 Hybrid

The transport company in Lübeck in Schleswig-Holstein (DE) runs its busses with a hybrid power.

In Municipality of Odense in South Denmark Region (DK) hybrid-busses (electric + diesel) have been introduced.

In the Agder County (NO), electric buses and bio-hybrids are considered to provide the best environmental benefits for buses operating in cities and densely populated areas. In the latest tender the buses that will traffic the city centre of Kristiansand will be hybrid or 100 % Electric. From 1 July
2018, 74 buses running on Euro 6 Hybrid Bio-diesel were introduced in Kristiansand-Agder. These buses are powered by electricity – and not by combustion engines - in the acceleration phase. According to the manufacturer, this is assumed to reduce the fuel consumption with at least 30%.

Scandlines Germany runs a ferry between Puttgarden and Rödby with hybrid power. More ferries shall follow.

In Vestfold-Telemark (NO) a number of hybrid buses (i.e. 12) are operated in Horten, Sandefjord and Larvik. The world’s largest (per February 2020) plug-in hybrid ship is operating the route between Sandefjord and Strømstad (Color Line).

Aberdeen City Council (UK) has now replaced the entirety of its pool car fleet for office staff by petrol/electric hybrid vehicles and also has a number of Petrol or diesel / electric hybrid vehicles in the service fleet. To compliment Aberdeen’s project for roll out and upgrade of electric chargers as an “electrified corridor” from Aberdeen to the North Coast of Aberdeenshire. The commercial bus operator on this route has now introduced a fleet of double deck diesel electric hybrid busses.

The Aberdeen City (UK) – commercial operator Stagecoach operate a number of diesel electric hybrid busses within the city and between the city and Aberdeenshire (may be duplication of the above).

The number of hybrid buses in Västra Götaland (SE) are also increasing. They are all using HVO biodiesel.

More than half of the public transport buses in the Region Örebro (SE) are running on HVO/FAME.

4. The use of alternative fuel in service vehicles

Schleswig-Holstein (DE) The land government uses alternative fuels for its own vehicles in some areas: Ministry of Interior (4 E-Mobile cars), Ministry of environment (1 E-Mobile car), and the Police on the Island of Helgoland in the North Sea (1 E-Mobile car). There are plans to extend the use of E-Mobile cars. The cars which are run with natural gas or hydrogen were tested as well, but not found suitable for what is needed in the public service. Due to low range and a poor infrastructure for charging the technology was found to be not efficient yet.

As far as E-Mobility is concerned almost every Ministry was equipped with chargers and there are plans to install more quick chargers at or around public buildings which allow to charge the batteries while parking.

The Schleswig-Holstein Agency for Coastal Defence, National Park and Marine Conservation is going to buy six new E-Mobile cars.

On the local level there are already many examples for the use of alternative fuels. Local administrations are responsible for that and decide independently on whether what and where to use it (see sections for the relevant fuel platform).

The Region of Southern Denmark (DK) has (in the central administration) a fleet of 12 cars to be used by the staff. 3 of them are e-cars – but they are quite seldom used because the action range is too small for most purposes.

The North Denmark region (DK) is using two 3.5 tons lorries on certified biogas for internal transportation in the health sector.
**Agder** (NO) has 6 electrical service cars with an own fast charging station A service vehicle for a secondary School in the county is running on bio diesel B30, a scheme which was evaluated in the autumn of 2015.

The inter-municipal (consisting of several municipalities) waste-treatment company in Vestfold-Telemark has phased all the renovation vehicles in the area over to biogas in the end of 2015. All renovation vehicles are now running on biogas.

**Vestland region** (NO) uses mainly electric cars. There is also one car run by hydrogen.

**Vestfold-Telemark** (NO) has a fleet of mainly electric cars to be used by staff in the central administration.

In **Västra Götaland** (SE), 39% of the service vehicles (the public transport excluded) runs on renewable energy. These service vehicles are primarily used in transport services for health care purposes. Ambulances account for 14% of renewable energy fuel and goods transport (primarily related to hospital goods transport) also represents 14% from renewable energy fuel.

In 2014, 96% of the vehicles procured by Region Västra Götaland were biogas, plug-in hybrid or battery-electric, but the majority was biogas.

Today there are more than 300 service vehicles (excluding public transport) in **Region Örebro** (SE). During November 2019, a procurement for the purchase of 250 new service vehicles started. The procurement consists of gas vehicles (120), electric vehicles (10), hybrid vehicles and pulsed-in hybrid vehicles (120).

In the **Halland county** (SE) the new car pool booking system Zenit together with the GPS that is mounted in all vehicles, it is now possible for the Region of Halland (SE) to monitor how the vehicles are used and how they behave. Some of the parameters that are monitored and logged are: kilometres used, distances, number of stops, how low it is being used, when it is filled up and with what fuel (renewable or fossil), all of which is compiled into an environmental report. The environmental report then serves as a base when it is decided which cars are replaced. The cars with the most negative influence on the environment are replaced first. Age or how many kilometres they have run is not used as criteria for replacement. When new vehicles are bought, the first choice is battery electric vehicles, but most of the time it is not possible because of missing charging infrastructure where they are being used. The second choice is biogas, where the gas mixture in Sweden is 90 percent biogas and ten percent natural gas. This choice is the most common. If there is no vehicle that fulfils the needs that run on gas or is battery electric, a diesel vehicle is chosen as the last option. All diesel engine vehicles run on HVO.

**Aberdeen City Council** (UK) despite electric clean fuel vehicle pilots in house being limited in the past due to past range limitations for the rural environment, Aberdeen now has 18 battery electric cars and vans in its own fleet and has converted the whole of its pool car fleet to petrol/electric hybrid cars for pool use by office staff. Aberdeen City Council is partner to the HyTreC2 project in the NSR programme and has now embarked on a long-term test of a programme to introduce hydrogen and FCRE vehicle into a rural setting and thus a has establish a regime to further upgrade 4 of the petrol electric hybrid pool vehicles to hydrogen fuel cell vehicles and integrate another 3 hydrogen vehicles into service use.

**Aberdeen City** has a range of electric and hydrogen vehicles in its’ fleet. These vehicles include cars and vans which are used by the Council and partner organisations in the city, such as the National Health Service and Scottish Environmental Protection Agency. In 2018, Aberdeen City trialled
hydrogen roadsweepers and garbage trucks. This investment in an alternative fueled fleet continued in 2019 with a further rollout of vehicles.

Orkney Islands Council (UK) has around 6 electric vehicles within their fleet. As part of the asset replacement programme, an electric vehicle will be considered in the first instance where it is appropriate.

5. Incentives and other schemes for the use of vehicles on alternative fuels

There are different schemes in operation in the responding member regions/countries for the promotion of alternatively fueled vehicles. Such schemes are ranging from tax/duty exemptions or reductions, free parking, access to public transport lanes, grants for pilots, partial grants and interest-free loans for the purchase of vehicles. These schemes are often part of larger national schemes in the different countries.

On the federal level in Schleswig-Holstein (DE) there are laws that allow for some advantages for owners of E-Mobile cars like free parking and reduced taxes.

In South Denmark (DK), this is a task for the municipalities, as the region has no authority concerning the infrastructure. The normal scheme is, that charging, and parking is free for e-cars (but there can be different schemes in the municipalities). Congestion charge and toll fares are not used in Denmark.

In Norway (NO) there is a national incentive scheme for electrical cars, which is resulting in a high uptake of electric cars in the general public. In 2020 battery electric and plug-in hybrid vehicles together hold a 50% market share. The goal in the national Transport Plan is that in 2025 only zero emission cars will be sold.

The incentives include:
- No purchase/import taxes (1990-)
- Exemption from 25% VAT on purchase (2001-)
- No annual road tax (1996-)
- No charges on toll roads or ferries (1997-2017).
- Maximum 50% of the total amount on ferry fares for electric vehicles (2018-)
- Maximum 50% of the total amount on toll roads (2019)
- Free municipal parking (1999-2017)
- Parking fee for EVs was introduced locally with an upper limit of a maximum 50% of the full price (2018-)
- Access to bus lanes (2005-).
- New rules allow local authorities to limit the access to only include EVs that carry one or more passengers (2016)
- Company car tax reduction reduced to 40% (2018-)
- Exemption from 25% VAT on leasing (2015)
- Fiscal compensation for the scrapping of fossil vans when converting to a zero-emission van (2018)
- Allowing holders of driver license class B to drive electric vans class C1 (light lorries) up to 4250 kg (2019).

The current Norwegian government has decided to keep the incentives for zero-emission cars until the end of 2021. The VAT exemption for zero-emission vehicles in Norway has been approved by the
EFTA Surveillance Authority (ESA) until the end of 2020. After 2021 the incentives will be revised and adjusted parallel with the market development.

There are more than 10,000 publicly available charging points and more than 1500 cars can fast-charge at the same time. By 2017 the Norwegian Government launched a program to finance the establishment of at least two multi-standard fast charging stations every 50 km on all main roads in Norway. With the exceptions of some of the most rural areas in the north, there has successfully been established fast charging stations on all main roads in Norway.

**Aberdeen** (UK) Local Transport Strategy supports the adoption of alternative fuel types including electrically powered vehicles. Organisations in Scotland can apply to the Switched On Fleet grant (funded by Transport Scotland) to fund ULEV lease or the difference between purchase price of the ULEV and equivalent fossil fuel vehicle. An allocation is available to each region for these purposes. The Government currently offers a grant to fund a percentage of the purchase price of an electric car up to a maximum. There are also grants available for electric vans. Additionally, funding is available to install a home charge point for electric vehicle. In the UK Electric vehicles are also exempted from vehicle tax and fuel duty.

**The City of Aberdeen** (UK) is offering charging in the public charging points.

The regional Sustainable Transport Program in **Västra Götaland** (SE) support projects that have a clear innovation dimension, but not infrastructure of fuel tank stations per se. The largest project in this program is ElectriCity, where the co-fund about 10 percent of a 250 MSEK (ca. 24 MEUR) collaboration aimed at demonstrating electric bus systems that can be integrated with the built environment (bus stops inside buildings). In a next phase of this project it will be demonstrated rubber-wheel electric high capacity transport using automated buss systems.

**Aberdeen City** (UK) has a range of electric and hydrogen vehicles in its’ fleet. These vehicles include cars and vans which are used by the Council and partner organisations in the city, such as the National Health Service and Scottish Environmental Protection Agency. In 2018, Aberdeen City trialled hydrogen road sweepers and garbage trucks.

As part of the EU-funded project ‘Civitas PORTIS’ one of Aberdeen’s ambitions was to complement the current work through the Hydrogen Strategy and help encourage the uptake of low-emission vehicles within the private sector, particularly hydrogen vehicles. Following a partner search Siemens and Royal Mail were selected for a pilot and both companies are trialling hydrogen-diesel vans as part of their daily operations. This partnership working is hoped to bring about an encouragement in the ‘greening’ of private sector fleet, demonstrating that these vehicles are commercially reliant and can operate similarly to a conventional vehicle. This will support the Council’s hydrogen ambition and help create a healthier and more sustainable urban environment.

The Sustainable Transportation Program in **Västra Götaland** (SE) supports public-private partnership and collaborative projects that have a clear innovation dimension in the region. Related to the fact that the region has the major Swedish vehicle and transport industry (for instance Volvo) and the major biorefinery manufacturing sites in our geography, the program focusses on autonomous vehicles, electrification, infrastructure, including efficiency in goods transport. In close collaboration and with a similar purpose as the transportation program, the regional Sustainable Energy & Bio innovation Program aims to support the manufacturing and the use of alternative fuels - biogas, liquified biogas and wind energy. The regional program’s portfolio hosts several of Sweden’s largest public-private-partnerships in these areas.
In Region Örebro (SE) initiatives for increased travel by public transport have been carried out primarily in the form of the EU project "Tänk tanken". The project has focused on behavior changing and information on how to get more citizens in the region to choose public transport, including try-on campaigns where commuters have been given the opportunity to try public transport for free for a limited period. The campaign was a great success, with over 4000 commuters taking part, of which about 800 chose to continue to use public transports after the trial period.

6. Charging and filling infrastructure

According to «elbilerne.dk» there around 50 places with charging stations in the South Denmark region (DK). At least 8 of them are fast charging stations. There are four bio-gas-stations (1 in Fredericia, 1 in Odense and 2 in Sønderborg). There are two hydrogen filing stations (in Vejle and Ejby) and two planned stations (Esbjerg and Kolding).

Groningen (NL) has at least four green gas stations. There are also three hydrogen stations in Groningen (Delfzijl, Hoogezand and Groningen). Together with Drenthe Groningen is investing in a network of 1000 public charging stations between now and 2020 (700 in Groningen and 300 in Drenthe). The tender for these charging stations has been done successfully and since April 2019 the role out of the charging stations has started.

There are also several charging stations for electrical vehicles in the Agder county (NO).

Vestland County (NO) have a good net of charging stations for electric vehicles, among these 418 fast-charging points.

A filling station for hydrogen opened in the winter of 2018 in the north of Bergen, and a new station opened in autumn 2018 in the south of Bergen.

In Vestfold-Telemark (NO) there are facilities for filling up biogas buses. A local production facility for biogas (Den Magiske Fabrikken / The Magic Factory) outside Tønsberg is producing biogas from food waste and fertilizer. In 2018 the factory produced biogas corresponding to 5.8 million liters of diesel. The production facility is expanding and a new production line for sewage sludge opened in 2018. CO2 will be used in greenhouses, so the production will generate positive gas emissions. One year’s production of biogas from Den Magiske Fabrikken can drive 507 times around the Earth by equator.

The first public filling station for biogas was opened inn Horten early May 2018. The next station in Tønsberg and was opened in June 2018. In June 2019 a filling station with liquid biogas (the second in Norway) opened in Vestfold, close to the motorway (E-18).

There are a number of charging stations for electric vehicles in the region, and especially along the main motorway (E-18) and in the urban areas.

The public transport system in Västra Götaland (SE) has its own dedicated infrastructure for HVO, biogas and electricity. There exists a publicly available infrastructure for compressed natural gas in the region. Physically about 50 percent of that gas is biogas and 100 percent biogas is available through contract linked to biogas production that feed into the gas infrastructure. One H2-station opened in October 2015, which is the second or third H2-station in Sweden.

The large European project GREAT was co-funded by Region Västra Götaland (SE) and has built 50 quick-charging stations in Sweden, including 17 in Denmark and 2 in northern Germany. The project has also built one LNG station. The project took place along the TEN-T Core network and was co-financed by with the Connected Europe Facility (CEF) of the European Union.
Furthermore, two of the region’s Science Parks, Lindholmen Science Park and Innovatum, are active in projects that develop schemes for electric charging infrastructure. In 2019, Västra Götaland had 1400 public charging points.

In Region Örebro (SE) there are 75 charging stations for electric vehicles, ten gas stations for HVO, one station for FAME (RME), six gas stations for biogas and 62 gas stations for E85.

There are six filling stations for compressed natural gas (CNG) in the Halland County (SE), where 90 percent of the gas is biogas. Two filling stations for Liquefied Biogas (LBG) are planned in the county during 2020 to 2021. There is no available information of all the public charging stations in the county, but most municipal parking areas, as well as private parking areas, have some parking spots with charging possibilities. The overall estimate for Sweden is one charging station for every eleven cars.

In Aberdeenshire (UK) 76 electric vehicle charger installations have or are being installed by Aberdeenshire Council to provide a publicly accessible capability of 150 charging spaces in addition to those available from other public and private institutions. In addition, the early generation EV chargers have now been replaced with more reliable modern units.

Aberdeen City (UK) has 55 electric charging points throughout the city, each being able to charge two vehicles at any one time. Rapid, fast and standard charging points are available to the public free of charge, 24 hours per day. The city is currently seeking to build on this by opening an EV hub, offering many charging points in a convenient single location with work expected to commence later in 2020. Aberdeen City also has two hydrogen refuelling stations – one mainly for refuelling of buses but both are now publicly accessible for refuelling of cars and vans.