

**Towards Sustainable Revolution –
Nordic Mobility in the Post-
COVID-19 Era**

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Photo: Jussi Hellsten

Introduction

What happens to Nordic mobility in a world of pandemic, lockdown, isolation, home offices and social distancing? Has the pandemic led us closer to a greener future, seeing that behavioural patterns may change almost overnight and automatically reducing our carbon footprints? Do Nordic businesses see new opportunities on the post-pandemic horizon, and what can be said about the role of Nordic cooperation in times of recovery and change?

Changing frameworks such as the current pandemic, but also the climate crisis and technological advancements are creating both a great need and new possibilities for innovation. For these reasons, Nordic Innovation developed the Nordic Smart Mobility and Connectivity program that aims to help develop a more sustainable, integrated and connected transport system Nordic region while generating opportunities for Nordic businesses.

We can now see that despite the sudden lockdowns, goods are still being transported across the globe and even the odd traveller, the infrastructure, is still in place and operating. The current pandemic has made us realize that without our mobility systems we would be much worse off. We also know that the pandemic is not here to stay, and that there are huge efforts being made across the Nordic

countries to make something good and positive come out of the crisis.

To showcase these efforts and to highlight the possibilities that collaboration across Nordic countries can bring, nine Nordic mobility projects co-financed by Nordic Innovation share their thoughts on the near future and their relevance in the post-pandemic era.

"Nordic businesses and mobility stakeholders seem to have spotted a general sense of willingness and daring to try out new solutions, to make the necessary leaps and to accept – and maybe even expect – radical change and joint goals for sustainable mobility. Nordic collaboration is seen as key to achieving impact and to creating the best possible solutions. Regional value chains are established or reinforced. This will give the Nordics a head start in the time to come", says Nina Egeli, Senior Innovation adviser at Nordic Innovation.



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Photo:NewsLab

Future ships can learn a lot from smart cities.

The connected ships of the future will be part of a much larger digital ecosystem, connecting industries that before now, had been far apart.

"If all the companies in the maritime sector were to continue developing their own digital solutions separately, it would be very costly first of all. Secondly, any environmental benefits from such an approach would take much longer to record and recognise. The only way to conquer our shared challenges is to work together," says Eva Errestad at RISE, Research Institutes of Sweden.

As process manager in the Connected Ship project, Errestad works with key players in the maritime industry to pave the way for a more sustainable future within shipping.

Lost in translation

One of the first issues identified in the project, was the fundamental difference between the IT and shipping industries.

"These are two completely different areas of expertise, with companies that have never worked together before. It's fair to say that things got lost in translation at the onset of the project," Errestad says.

Amongst the participants in the Connected Ship program, you can find a good mix of different stakeholders: shipowners, maritime subcontractors, IT companies and cluster organisations from Sweden, Denmark and Finland.

"The differences between the two actually became quite apparent in the very beginning of the project, as both industries were new to each other's working methods. Since these issues have been ironed out, progress has been very smooth," Errestad says.

"Our goal is to deliver a digitalisation platform onboard a ship by utilising technology, platforms and knowledge gained from smart city projects, combined with maritime industry control systems, communication protocols and

environmental prerequisites," Errestad explains.

None of this would be possible without all the participants working together harmoniously. "Another main goal of the project is to facilitate data sharing on a large scale, by identifying and utilising standardised platforms. Good communication and cooperation between all stakeholders is therefore essential throughout all aspects of the project."

Prepared for the future

As the connected ships of the future will be part of a much larger digital ecosystem, it's clear how important large scale data-sharing is to this project.

"This will prepare the ships for smarter interactions in future with harbours, trucks, cargo, passengers and other smart micro-systems," says Errestad.

She adds: "The goal is to create a platform which collects and controls non-critical data in mass. The platform must be able to handle data access policies, enabling data analytics, AI automation and other services to access data, devices and control systems."

By connecting critical systems to the ship's own platform, shipowners will also be able to analyse data across several platforms, improving vessel performance in several areas.

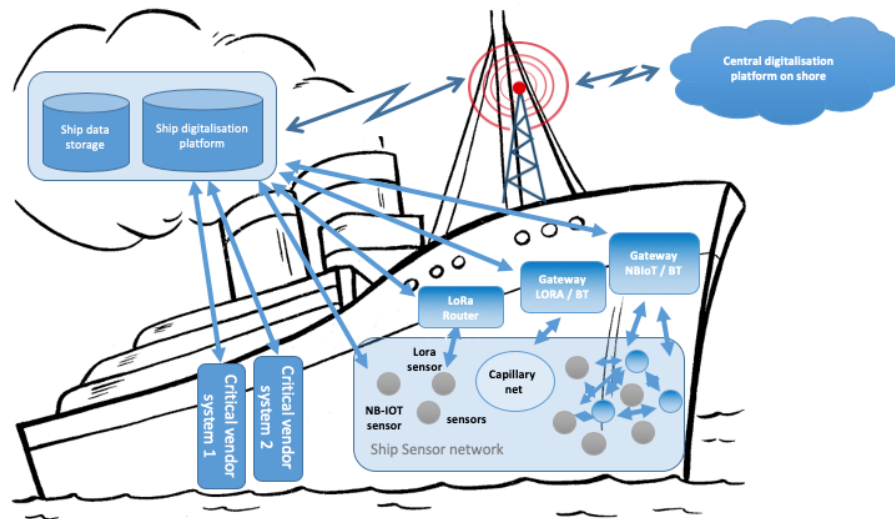
"A much broader and more precise database will enable energy consumption reduction, cutting both costs and CO2 emissions," Errestad says.

Using data collected from several vendors, the Connected Ship will serve as a platform for open innovation, Errestad explains: "Transparency and collaboration are key aspects of the project, meaning findings will be shared during and after the project."

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The only way to conquer our shared challenges is to work together.

Eva Errestad, RISE Research Institutes of Sweden



Connected ship concept

Illustration: The Connected Ship

Learning from smart cities

Some of the technologies used in the project are more commonly associated with smart cities. Bringing these technologies on board is not a straightforward process.

"Integrating wireless solutions in smart buildings is rather different in comparison with smart ships. The confinements of a ship means that wireless solutions are restricted in an environment mostly consisting of massive steel hulls," Errestad says.

Adding new sensors to an existing system is also a more complicated and potentially costly process.

"That brings us to other measures that the project will have to take into account including business models for the different user cases. Shipping is known for tough demands on return on investment, so attractive business models are essential for any technological breakthroughs."

Currently, the project is aiming for a first pilot run on a ferry this October (providing the border has opened between Denmark and Sweden).

"The user cases will focus on security, energy efficiency and preventative maintenance in order to create long-term sustainability, and a speedier transparent development of digital solutions onboard vessels," Errestad says.

Nordic frontrunners

Just as many vessels stopped running completely during the first months of the COVID-19 pandemic, the virus put parts of the project development on hold as well.

"It did mean meetings became more accessible, with all parties working online and remotely. This has actually benefited the sharing of knowledge amongst everyone,"

Errestad says.

With a multitude of partners from the Nordic countries involved in the Connected Ship project, it has meant the project has had full access to a plethora of cutting edge technologies.

"The Nordic countries are all unique trailblazers in different technological directions, but all of them are working together in tandem on this project. The Connected Ship project and others alike are essential for the Nordic countries to sustain their position as frontrunners of green and sustainable development in the maritime sector and general digital development," Errestad says.

She believes that COVID-19 will encourage the creation and nurturing of regional value chains all around the globe: "With projects like this, we should try to benefit from the fact that right now, even if geographical distance prevents physically meeting, we're all closely connected both online and culturally at an increasing rate. This is a competitive advantage in itself."

The Connected Ship

- The goal of the project is to deliver a digitalisation platform for ships by utilising technology, platforms and prior knowledge gained from smart city projects. This, combined with maritime industry control systems, communication protocols and environmental prerequisites, will also prepare the ships for future interaction with the smart society - harbours, trucks, cargo, passengers and other smart micro-systems.
- Running for three years from 2019-2021.
- **Project partners:** Mobile Heights, VASEK, Svenskt Marintekniskt Forum, Sensative, Beijer Electronics, Wärtsilä, Maersk Tankers, Life Finder, SEAIT, Accelerated Growth, MDC.



Photo: NewsLab

The big hydrogen push: "We need a radical transformation"

The Nordic countries have taken the global lead in hydrogen technology. What's the next step?

Hydrogen is the most commonly found element in the universe. It's easy to manufacture and transport, plus it's packed with energy. Could it be the solution to global warming?

Potentially a significant part of "the solution", but not yet. According to hydrogen entrepreneur Knut Linnerud, the technology needed to provide expansion to hydrogen-powered vehicles is currently at an impasse.

"The government says that there must be enough hydrogen-powered cars on the road for them to build the infrastructure needed to keep them running. However, the car manufacturer says that they can't produce the cars before the infrastructure is in place," Linnerud explains.

It's a tricky problem to try and solve. Especially because the technology needed requires massive investment. Linnerud explains that for hydrogen technology to succeed and be profitable, it has to operate on a large scale.

"Small scale projects are not sufficient. We need a radical transformation," he says.

Cutting emissions

That's the motivation behind *Next Nordic Green Transport Wave – Large Vehicles*, a collaborative project with members across the Nordic countries. The project aims to bring about a hydrogen revolution, by laying the groundwork to roll out infrastructure for hydrogen-fuelled trucks and buses.

Cooperation between the Nordic countries is critical, Linnerud says. To achieve this, Next Wave provides a platform for starting a dialogue between technology providers and both local and national authorities in Sweden, Finland, Denmark, Norway and Iceland.

"We need to learn from each other, then identify and replicate the solutions that work."

The ultimate goal is to use hydrogen to drastically reduce transport emissions. After electricity and heat, transportation is the sector with the highest global CO₂-emissions. This means the potential impact hydrogen can have within this market segment is huge.



Knut Linnerud, Project Manager, Kunnskapsbyen

Photo: NewsLab

Electric success

The world's first publicly available hydrogen-fuelling station opened in Reykjavik almost 20 years ago. Today, there are just a few hydrogen-fuelled trucks and busses on the roads. The Norwegian grocery wholesaler Asko put one of the world's first fleets of hydrogen trucks on the road earlier this year. The company's four trucks can run for 500 kilometers each after one refuelling stop, and solar panels on the company's office building are used to produce their hydrogen.

These trucks showcase the potential of the technology, but they also illustrate how important Nordic collaboration is. The truck platform was provided by Scania in Sweden, the lightweight hydrogen storage tanks were developed by Hexagon in Norway, the fuel cell was made by PowerCell in Sweden, and the refuelling solution was built by Nel in Denmark.

Linnerud thinks the time is right to take the next few steps. Parts of the transport sector have already taken a great leap towards electrification in the last few years. The Nordic countries have lead the way for the rest of the world in electric vehicle usage. One in every four cars sold on Iceland is fully electric. In Norway it is nearly one in two, and the country plans to stop sales of fossil-fuelled cars by 2025.

Whilst well on track for a greener future of passenger vehicles, the same progress is yet to be made with heavy-duty transportation.

"Both batteries and hydrogen are important measures to implement zero emission vehicles of all sizes. However, it is important to consider the long term goals when trying to predict the return of investment for both the private and public sector," he says.

"For quicker refill and longer distances, hydrogen has its advantages. For quick implementation, battery is a lot easier, at least in countries with well established electricity infrastructure, such as Norway. Hydrogen, on the other hand, requires great investments to offer a sufficient, flexible infrastructure. But what we have found is that the long term the cost of hydrogen infrastructure is fully competitive with electric infrastructure for batteries."

It might be easier and more cost effective to introduce hydrogen infrastructure for heavy-duty transport vehicles, than for personal vehicles. Buses and trucks typically follow specific routes and require less infrastructure overall.

"We could build corridors of hydrogen fuelling stations along the main roads between big cities," he says. "That's the reason why hydrogen and fuel cell technologies may be ideal for the decarbonisation of heavy-duty or long-range transport."

The need for a stabile energy source

It is difficult to predict the future, and the COVID-19 pandemic hasn't made that any easier. Still, Linnerud remains optimistic for the future.

"A lot has changed in a short period of time. But this rapid change has been met with innovative solutions in many sectors. There might even be more room for innovation than there was previously. Psychology is a big part of it. Some might decide to put everything on hold, while others are finding out what new things they can do in this unique time."

Linnerud hopes hydrogen technology can be a real game changer.

"We need to produce more renewable energy. The growing challenge for renewable energy, is that you also need to build energy storage proportionally to the energy capacity if you are to get optimal usage of the energy being produced. With hydrogen, we can store the surplus wind and solar energy we produce during the day."

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We need to learn from each other, then identify and replicate the solutions that work.

Knut Linnerud, Project Manager, Kunnskapsbyen



Photo: Heart Aerospace

The Nordic countries are leading the way towards sustainable air travel. Norway aims for all short-haul flights to be 100 per cent electric by 2040, and Sweden aims for all domestic air travel to be fossil-fuel free by 2030, and all international flights departing from Swedish airports by 2045. Finavia in Finland and Avinor in Norway have both introduced the first electric aircraft in their respective countries, and Elfly AS has ordered 18 electric trainer aircraft and led the acquisition of another 60 aircraft for flight schools in Sweden and Norway.

"Many parties have joined the race to build the first electric passenger aircraft. Sweden's Heart Aerospace has ambitions to get their electric plane ready by 2025. But getting an electric plane airborne is much more than just building the aircraft itself," says Melinda From, process manager for NEA at RISE, Research Institutes of Sweden.

"You also need everything from updated charging standards, new infrastructure on the tarmac, and possibly even new business models. It's not inconceivable that we will need new airline routes when we get electric planes in the air," From says.

From the Nordics, to the world

The Nordic Network for Electric Aviation invites key players in the Nordic aviation industry to pave the way for the introduction of electric aviation in the Nordic countries. This will hopefully facilitate collaboration within infrastructure, industry and business modelling.

"The Nordic countries have all the factors needed to lead the way for a modern new world of aviation. We are technologically advanced with the necessary resources and green mindset to actually make things happen," From says.

The goal of NEA is to create a platform for sustainable future air traffic, both from a Nordic and a global perspective, she says. "Alone we are quite small countries, but together we are the 11th biggest economy in the world and can make a difference globally."

The changeable Nordic weather conditions even make for a perfect testing ground for the planes of the future.

"If electric planes can fly in our airspace, they will work in the rest of the world as well. In addition to high winds, short runways and ice formation, low temperatures can affect the battery capacity of future aircraft, From says.

Many questions still to be answered

Until the first electric planes are ready for commercial use, From points to a multitude of questions that need to be answered.

"Is it possible to combine a biofuel tank with an electric airplane? How must the tarmac area be arranged? Do we need separate areas for electric planes at airports? New questions are appearing all the time. While new technology is going to be necessary if we are to succeed, it is not the only factor needed to make a full transition to green aviation. We must all be working towards a common goal of creating a sustainable future for the aviation industry. Not just in the Nordic countries, but throughout the world."

The aviation industry can appear to be stubborn and unchangeable, with a lack of willingness to restructure and modernise. According to From, the truth is quite the opposite.

"This is a truly global industry with functioning means of cooperation. The capacity it has for finding solutions across borders is therefore great. If the airline industry cannot adapt, no one can," From says.

"We must not forget that it is in fact the Nordic airlines that have driven the sustainable development in this area, with largely voluntary measures impacting their profit margins. That's also in the midst of a time where they are struggling more than ever before."



Cutting emissions and costs

The Nordic airline industry has not only realised that a shift to greener energy is necessary to be able to secure its own future, but also that it can provide an incredible financial boost, says From.

"The overall goal of NEA is a significant reduction in CO₂ emissions from air traffic, but it can also be far cheaper to operate electric aircraft."

From mentions a potential 50 percent reduction in maintenance costs at the airport, as well as saving on the cost of standard aviation fuel.

"These are things that can be absolutely crucial to whether it is possible to operate a healthy aircraft operation in the future," From says, adding that the work done in the NEA project is both "realistic and optimistic":

"There is no doubt that these changes will happen, the question now is just how. Having this drive is important, especially in these times with everything we've been through," From says, referring to the shutdown in air traffic as a result of COVID-19.

"The global pandemic made the issues we are working on much clearer to us all. The need for a greener alternative for the future is more evident than ever. Many people are wanting to invest in green solutions, at least here in the Nordic countries."

From goes on to say shutting down the borders and the immediate effect it had on our travel habits, have clearly shown the need for airline travel in the future.

"Like everyone else, we have become good at conducting meetings digitally. But at the same time, we observe that we must be able to meet each other in person in order to achieve certain things. We have to experience other cultures and view things from different perspectives to understand the bigger picture. Whilst many more meetings will be held digitally, when we have the opportunity to travel again, it should be done in a sustainable way. That's what we work for in NEA."

"Everything is connected"

At the same time, From appreciates the fact that the Nordic Innovation program covers other forms of transportation as well.

"We cannot solve the transport challenges of the future if we look at each mode of transport individually. Everything is connected," From says.

"If trains became the primary means of travel, we would require more extensive interventions on the ground, the influx of train passengers could mean fewer freight trains, meaning added pressure on the road network. Air traffic will therefore be a crucial transport factor for the Nordic countries and the rest of the world also in the future."

Up until now, political governance on these topics have mostly been run at a national level, From says. "Norway and Sweden have both leaned towards electrification as a solution. I myself am quite sure that electric aircraft will be part of the solution, but

biofuels will be necessary to achieve our goals in the short and longer term."

The work done in the NEA project is an important part of establishing the future of air travel in the Nordic countries, From says. "The various airlines in the region were quick to give their support to the initiative."

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If electric planes can fly in our airspace, they will work in the rest of the world as well. In addition to high winds, short runways and ice formation, low temperatures can affect the battery capacity of future aircraft.

Melinda From, Process Manager for NEA, RISE Research Institutes of Sweden

Nordic Network for Electric Aviation (NEA)

- A platform where major players come together to accelerate the introduction of electric aviation in the Nordic countries.
- Facilitates collaboration within infrastructure, industry and business modelling.
- Running for four years from 2019-2022.
- **Project partners:** Air Greenland, Avinor, BRA, Elfly, Finnair, Heart Aerospace, Icelandair, NISA, RISE, SAS, Swedavia Airports, Fossilfritt Flyg 2045, Finavia, Copenhagen Airports CPH, Svenska regionala flygplatser



Photo: iStock

Seamless travel

Hovland, the manager of ITS Norway, frequently travels as a part of his job. As a result, he has about 40 mobility apps installed on his smartphone.

Buying tickets and submitting receipts across different transportation systems is both a time-consuming and inefficient way to travel.

But that could all change. He's part of a project that will allow you to use only one app to travel all across the Nordic countries. You'll also be able to stay on an app that you're already familiar with.

Say you're living in Oslo and you're already using Ruter's app to get around where you live. Hovland wants you to be able to use the same app to order a taxi when you're partying in Reykjavik, or to check the bus schedule while you're kayaking near the small town of Mariehamn on Åland Islands.

"The Ruter app will show you how long it would take for a taxi to pick you up, or if your bus is delayed. Plus, you'll be able to pay for the entire trip in one app," Hovland says.

The project is called NOMAD (Nordic Open Mobility and Digitalisation), and is a collaboration between several companies in the Nordic region. It could be the next chapter in the rapidly developing mobility industry.

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Maas enables flexible usage of various mobility services and transportation, giving a wide range of choice for people for traveling. It makes it possible to take into account the special conditions required for the pandemic, enabling safe traveling.

Trond Hovland, Trond Hovland, Managing Director, ITS Norway

The dream

NOMAD will make it easier for mobility businesses to develop and offer services to a larger international audience, says Pekka Niskanen, chief operating officer of Kyyti Group, a core member of the project.

It is the world's first attempt to create international roaming for mobility, similar to what Nordic Mobile Telephony did for international telecoms roaming (GSM).

"Our dream is to do for mobility, what Nordic Mobile Telephony have done for telecommunications," he says. "We believe that the Nordic countries are in a prime position to develop it. We are tech-savvy, and we have a long history of co-operation."

Kyyti offers a Mobility-as-a-Service (MaaS) platform, which enables combining various mobility services to be offered as one multimodal experience through one app. Niskanen thinks NOMAD will create huge opportunities for the mobility sector.

"Because of the roaming possibility, MaaS platform providers can expand their market throughout the Nordics. Companies like Kyyti may also export the cutting edge technology around the world," Niskanen says. "This may open up new, lucrative markets to us."

Quicker, cheaper and greener (literally)

The roaming service NOMAD is developing will provide much more than the cost and length of your journey, Hovland explains. It will also tell you which transportation to take if you want to reduce your carbon footprint, or even which mode offers the most scenic route.

Whilst that's the end goal, collecting the information necessary for it to run smoothly remains a big challenge. In addition to maps and train timetables, an effective mobility app needs constant updates on traffic, plane capacity and live locations of every bus and taxi. In every town and city.

"If you own the entire production like Ruter in Oslo, this isn't really that hard to collect," Hovland says. "But it quickly gets difficult when you have to coordinate with lots of different operators."

Acquiring data from larger public operators is one thing, but from smaller private companies is quite another.

"We have 15 different taxi companies in the Oslo region alone, and several different electric scooter rentals. To collect this data from all the different companies in real time, is a lot of work. But if we don't do it, we don't get to use the entire mobility system."

One of the reasons Hovland thinks NOMAD could be successful, is that he thinks the project creates a win-win scenario.

"Sharing their data would be more appealing, because taxi companies can still maintain direct contact with customers through their own app," he explains.

Could COVID-19 change how we travel?

NOMAD is still in its early stages, having only begun last Autumn. Unfortunately just a few months into the project, nearly all travel between the countries ground to a halt. With such a severe shock to the status quo, the way we travel may now change in the long-term, Hovland admits.

Instead of frequent business trips to neighbouring countries, meetings are more likely to take place online. In short, that means it might be much more pleasant to travel in the future, but it's quite possible fewer people will do it.

In the long term, Niskanen believes the virus will accelerate deployment of MaaS.

"Maas enables flexible usage of various mobility services and transportation, giving a wide range of choice for people for traveling. It makes it possible to take into account the special conditions required for the pandemic, enabling safe traveling."

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Pekka Niskanen, Chief Operating Officer of Kyyti Group



Photo: iStock

Inspired by the world of telecom

Whilst the COVID-19 virus could have a transformative effect on how we travel, it

isn't shutting NOMAD down. The inspiration behind the project comes straight from the earliest days of the world's telecommunications.

The first transcontinental telephone call was made in 1915. At one end of the line in New York, was Alexander Bell, the inventor of the telephone. At the other end in Los Angeles was his assistant, Thomas Watson. An incredible feat of engineering at the time, though we should be glad that today's long distance connections are a little more seamless than they were a hundred years ago. The call took 23 minutes to connect, with five intermediary telephone operators manually patching the route of the call.

"At one point there were about a million operators that manually connected people from coast to coast. Now, this happens automatically. If one station is busy, the signal finds another one. When we make a long distance call, several companies may be involved in connecting us together, not only our telephone providers," Hovland says.

NOMAD uses the same technology with mobility. They are developing an enabler platform that your mobility app can 'roam' in the same way your phone roams when you're abroad.

"Imagine the way you can subscribe to one telecoms company, but roam freely in that ecosystem. The idea is to have the same set up for transport services."

Currently, half of the NOMAD project is preparing the mobility data for the market, and the other half is setting up mobility services based on a roaming model.

Will it work? Hovland says "the proof is in the pudding."

"This is an experiment and a stepping stone. We had to try something new. We have already done so many other things that haven't worked.

Nordic Open Mobility and Digitalisation

- Mobility-as-a-Service (MaaS) enables an individual to plan and pay for travel on almost every mode of transportation using a single mobile application.
- The project will introduce a market framework of technology and business practices for MaaS and other smart mobility services.
- It draws its inspiration from the success of Nordic Mobile Telephone that demonstrated Nordic collaboration could transform a technology hindered by a divided marketplace, into its current streamlined state.
- Running for three years from 2019-2021.
- **Project partners:** ITS Finland, ITS Norway, ITS Sweden, Kyyti Group, RISE, TØI, The Capital Region of Denmark, UbiGO, ITS Danmark

Collaboration provides fresh air for Nordic offshore wind

The coming years will see an increase in demand for clean energy, and wind power will play a crucial role in tackling climate change. With the world slowly recovering from the COVID-19 pandemic, a collaborative Nordic effort will provide the winds of sustainable change.



Photo: iStock

Ideal Nordic coastlines

The bold NOW Ports (New Offshore Wind Ports) project that Ms Jepsen is a part of, will uncover and develop clear opportunities for collaboration and strategic innovation between the Nordic countries. The project will unite several key offshore wind players to reshape the industry to meet future demands of wind power.

"Nordic countries have long coastlines, well-suited for future wind farms, so there's great potential to take advantage of the transition to ocean wind, especially from the North Sea and the Baltic Sea," says Ms Jepsen.

"The offshore wind industry has yet to realise the potential for industrialisation or cost reduction from energy that comes with strategic innovation, plus the standardisation of equipment and procedures that reduce under-optimised logistics, service, and maintenance."

The NOW Ports project aims to rectify this. By providing a well-connected forum for strategic innovation, the methods they uncover will provide the groundwork for six joint innovation projects for Nordic ports and port spaces.



Lisbeth Brøde Jepsen, Project Manager, Energy Cluster Denmark

Photo: Jonas Fotografi

Defining future opportunities

Although the project is still in its infancy, three ports have already been identified for the collaborative effort—Rønne Havn in Denmark, Trelleborg Havn in Sweden and Karlskrona Port on Norway's west coast. All three are connected to the Baltic and North Sea's, respectively.

Offshore wind developers, original equipment manufacturers and subcontractors are invited to collaborate in upgrading, redesigning and adapting the facilities and infrastructure around the port spaces.

"Through this method of inclusion, we hope to promote well-defined, long-term innovation opportunities for both investors and industries surrounding the ports," says Ms Jepsen.

Providing a template for delivery through a common direction, is equally important.

Undeterred progress

Perhaps due to the NOW Ports project still being in the planning stages, setbacks during the COVID-19 pandemic haven't been too severe. Ms Jensen's chooses to remain optimistic for a post-COVID-19 industry.

"It's been possible to conduct successful international digital meetings with a lot of

participants. New online tools have been implemented, a lot of people have become well acquainted and learnt to network online together."

Through what they call "Cyber-Physical meetings", Energy Cluster Denmark are planning to conduct meetings where Ms Jensen, as project lead, attends the Swedish or Norwegian partner's meetings with their respective country's port. "If these meetings are successful, we'll consider developing the concept further.

Despite the immediate toll all industries have taken during the pandemic, the climate crisis will remain a prominent issue to face. As the global community slowly returns to normal, new opportunities will arise. Governments need to create jobs to get their economies back on track, and the early signs are that building for sustainable future is still very much on the worldwide agenda.

The need for more clean energy is still urgent as ever, and the work of the NOW Ports project has the potential to be an important building block for future, greener societies.

"Offshore wind ports are such an important point of contact for developers, equipment manufacturers, and logistics and service providers. If the industry is to sustain the expected growth in demand, both existing and new facilities and infrastructure must be able to handle it," Ms Jepsen concludes.

A roadmap for cleaner port cities

Connecting ships to the grid while they're in port can have huge environmental benefits. A new study aims to establish how much port cities stand to gain.

At port, ships must keep their engines running to power their onboard systems. This results in polluting emissions such as sulfur oxide, nitrogen oxide, particles and carbon dioxide that heavily contribute to high greenhouse gas levels and reduced air quality in port cities.

One potential solution is an onshore power supply, connecting ships to the grid using the port city's electrical supply instead. This virtually eliminates pollution from stationary ships. So why isn't it standard for all ports?

"Onshore power supplies can reduce environmental impact of ports. But exchanging the existing power supply of ships whilst they are docked requires a substantial investment in technology," explains Niels Freese, business developer at Danish Maritime.

High costs and a lack of clear and obvious environmental benefits mean that many ports are hesitant to invest in onshore power supply solutions.

A new feasibility study aims to track what costs, opportunities and benefits of onshore power in Nordic ports. A cross-country collaborative study between Nordic marine clusters, companies and research institutions, the study will explore the technical possibilities, financing opportunities and environmental benefits tied to onshore power solutions.

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We want to make sure that decision makers in the Nordic region become more aware that onshore power supply is a viable investment with clear environmental benefits.

Niels Freese, Business Developer, Danish Maritime



Photo: NewsLab

Freese hopes that the study will provide a clear roadmap for ports considering onshore power supply.

"We want to make sure that decision makers in the Nordic region become more aware that onshore power supply is a viable investment with clear environmental benefits," he states.

The feasibility study will run over a 12-month period, commencing this August.

"During the project, the partners will compile information on technical opportunities, experience from existing plants and financial options. Then we will write an extensive report based on this research, and put together conferences," Freese explains.

Huge opportunities

According to Freese, providing onshore power to ships could cause a ripple effect of positive benefits for Nordic countries.

"The parties involved in investments of the ports will benefit from the extensive knowledge gained. If we also manage to increase the demand of onshore power supplies here, Nordic suppliers of the plants and technology can seal themselves a strong market position. Ports will be able to attract ships which ask for onshore power supply".

More importantly, onshore power supply can help cut air pollution and greenhouse gas emissions drastically.

"Heavy fuel oil used onboard is substituted with power from the grid. In the Nordics, this is to a large degree provided by renewable energy sources, meaning combustion

of fossil fuels is replaced by sustainable energy sources."

Perfect timing

The COVID-19 crisis has left parts of the maritime sector in financial limbo. Freese believes this feasibility study arrives just at the right time to offer positive direction during these uncertain times.

"Many ports are now in a vulnerable economic situation with limited investment opportunities, meaning they're hesitant to invest in new technology and infrastructure. This makes the timing of the project ideal, as it gives much needed support to onshore power supply projects."

With or without COVID, Freese is clear that the Nordics will become a hotspot for clean ports.

"We expect onshore power supply plants to become the norm in large ports in the Nordic region, simply because it allows us to keep cities and fjords cleaner."



Business Developer, Danish Maritime

Photo: Danish Maritime

Ammonia can unlock zero-emission shipping

Six Nordic companies have banded together in an attempt to kickstart the process of decarbonising the shipping industry. Undeterred by the COVID-19 crisis, their innovative project aims to create green fuel from a well-known commodity in ammonia.

When tackling their own industry's emissions problem, shipping and tech companies look to what can be done with the actual ships. The common problem they're faced with, is how to create new propulsion systems that run on zero-emission fuels.

The ZEEDS (Zero Emission Distribution at Sea) initiative started by tech company Wärtsilä, takes the opposite approach, by trying to develop an efficient infrastructure for distributing green fuel. The idea is to create a global network of offshore production and distribution hubs, where ships can refuel with a new form of climate-friendly energy fuel.

"Before we launched ZEEDS in 2019, there wasn't much buzz around ammonia as a clean alternative to oil and diesel," says Cato Esperød, Sales Director at Wärtsilä Norway. "From the feedback we received, we quickly realised that quite a few others were starting to have the same idea. Over the last year, the discussion has changed drastically."

This indicates that there is a real opportunity for international collaboration for the ZEEDS partners.

Joining Wärtsilä, are leading project specialists Kvaerner, offshore engineering and technology experts Aker Solutions, international shipping and logistics company DFDS, multinational energy company Equinor and Grieg Star, an international shipowner.

What is green ammonia?

- Green ammonia contains no carbon as it is produced by using hydrogen from water electrolysis and nitrogen separated from the air.
- A leading alternative for a zero-emission fuel, ammonia has higher energy than pure hydrogen.
- Today, more than 180 million tonnes ammonia is produced annually, making it the world's fourth most produced compound.
- Ammonia-based fuel would require less new infrastructure than other alternatives since it's already transported by ship in large quantities.

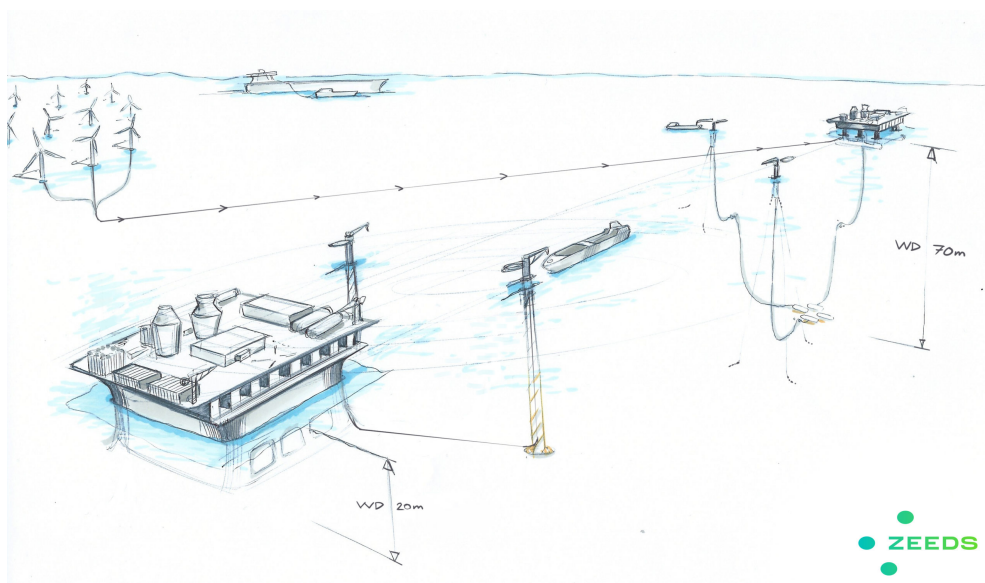
A flexible commodity

So, why ammonia? As Mr Esperø points out, the compound better known for its use in fertiliser or cleaning products, hasn't been talked about as much as LNG, hydrogen, or liquid nitrogen.

"First of all, green ammonia is hydrogen-based, meaning it doesn't contain any carbon. It also has the advantage of having a higher energy density than other green fuel alternatives. And thirdly, the global production of ammonia is already huge, so the infrastructure for distribution and storage is already in place," Mr Esperø explains.

Ammonia is a highly-usable commodity. 180,000 to 200,000 tonnes of ammonia is transported globally, every day. By using a compound already available across the world, there won't be any need to persuade a whole new generation to view ammonia as a fuel. That said, the problem it will be used to solve remains a daunting one.

Maritime shipping accounts for a whopping 940 million tonnes of CO₂ emissions per year. This amounts to 2-3 per cent of the global greenhouse gas emissions. A recent European Commission report on ship fuel oil consumption found that if the shipping sector were a country, it would rank sixth in the amount of emissions produced in the world.



Concept illustration.

Illustration: ZEEDS / Wärtsilä

Concise, realistic and scalable

Putting it bluntly, just a few carbon-neutral ships in operation simply won't be enough. "Building green infrastructure is of utmost importance," says Mr Esperø.

"For us to successfully cut emissions, more than 1 million tonnes of the daily fossil fuel consumption must be replaced by 2.3 million tonnes of green fuel."

The ZEEDS initiative is well aware that a propulsion system needs to be developed, approved, and implemented across fleets of vessels. But it's their offshore production and distribution hubs that will turn the tide for an industry hard-pressed to reduce emissions. These will consist of fuel hubs set up next to offshore wind turbines and are designed as two-level platforms. On the first level, hydrogen is produced from water, utilising energy created by the wind turbines. On the second level, the hydrogen, along with nitrogen extracted from the air, will be used to create green ammonia.

The ammonia fuel can be stored in seabed tanks. When a ship comes in for refuelling, easily manoeuvrable EPVs (Energy Providing Vessels) are used to bunker them, providing the ship with enough fuel for eleven days after just one hour of docking. Fuel stations can be located in highly trafficked areas, meaning fewer necessary visits to ports, and a reduction in port traffic over time.

"From the beginning, our goal was to identify the quickest route to zero-emission shipping. Our concept needed to be concise and realistic, meaning it had to be scalable and utilise existing technology. Ammonia is a known commodity – Yara has produced it for a hundred years!" Mr Esperø says.

This makes the benefits of ammonia even clearer. The infrastructure investments needed to make the shift to zero-carbon energy amounts to somewhere between \$50-70 billion annually for 20 years. But with ammonia, the industry can reap the benefits of a well-established infrastructure for production and supply.



ZEEDS partner workshop. Cato Esperød, Sales Director at Wärtsilä Norway (on the right in the picture).

Photo: Benjamin A. Ward / Wärtsilä

Zero Emission Distribution at Sea (ZEEDS)

- The project's vision is a network of offshore platforms that uses wind power to produce, store, and distribute zero-emissions fuels in a network of clean energy hubs.
- The Goal is to have a functioning full-scale demonstration ready within 5-7 years.
- One of the pre-projects funded under the Nordic Innovation Mobility Mission: Sea Meets Land. The aim of the mission is to decarbonise Nordic ports, transport of people and goods – on and between sea and land. The most promising project will be selected for additional funding after the first project year.
- Runs from 2020-2021.
- **Project partners:** Aker Solutions, DFDS, Equinor, Grieg Star, Kværner and Wärtsilä

Building green shipping infrastructure with cross-Nordic collaboration

A new Nordic collaboration platform will ease the transition to a zero-emission maritime future.

The global commercial fleet now counts over 100,000 vessels, which emit some 940 million tonnes of carbon dioxide annually. By 2050, these emissions need to be halved with the aim of eventually removing them altogether.

To get there, a few things need to happen. On one hand, there is a need for widespread innovation to make low and zero-emission shipping technologically and economically feasible. But equally important is the infrastructure and value chains on land, as Lasse Pohjala, business advisor at Vasek, a Finnish business development company, explains.

“Take electric shipping, for example. Electric ship propulsion is a significant challenge, but so is the infrastructure onshore, on harbour, that must be developed. You’d need to be able to charge vessels in each port. This means for example that you need universal charging plugs, so that every port has the same kind of charging plug. In the maritime sector, this kind of standardisation takes a lot of work”.

And when the world’s entire shipping fleet switches from oil-based fuels to electricity, hydrogen, Liquefied Natural Gas (LNG), or even ammonia charging plugs are just the tip of a large iceberg of potential challenges that have little to do with a ship’s engines or design.

The MAREN project (Maritime Energy Transition), a new, Nordic-wide collaborative effort, seeks to address these issues. By bringing together research institutions, port authorities, and maritime enterprises, the project aims to prepare the Nordic maritime sector for a green energy transition.

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The maritime market is not just Nordic, it is global. We become stronger when we cooperate, which makes it easier to compete globally

Lasse Pohjala, Business Advisor at VASEK Vaasa Region Development Company



Photo: iStock

Unique opportunity for Nordic collaboration

One of the biggest issues the project faces is the uncertain future of various marine fuels.

"The key challenge is to get rid of fossil fuels. But how? One solution is to switch to Liquefied Natural Gas (LNG) to cut emissions. We are currently working with ports to build LNG infrastructures, but as LNG is still a fossil fuel, it's a short-term solution for the next thirty years or so. After that, we need ships that run on clean, sustainable energy such as electricity or hydrogen"

"We don't know which propulsion technology will be dominant in the future, so we have to try to determine which is the correct infrastructure we must put in place," Pohjala adds.

By introducing a wide-reaching collaboration platform, MAREN seeks to ensure that key Nordic stakeholders are on the same page about these kinds of issues.

"Our aim is to create a robust platform to develop a lasting Nordic understanding about the future possibilities in this area. We have to build a cluster network almost from scratch. To date, there isn't really a network for cooperation on these issues."

The aim of MAREN is not just overall preparedness for a marine energy transition. It is also about providing new opportunities for Nordic companies.

This kind of co-operation provides unique opportunities for small and medium-sized enterprises, as well as large. Maritime business is huge, and the purpose of MAREN is to inspire collective Nordic co-operation where all businesses can benefit.

By building on each other's strengths, Pohjala believes the Nordic countries can punch above their weight in the international maritime market.

"Cooperation is the key word here. For example, Finland is leading on propulsion technology, Norway is strong on all offshore-related issues, Denmark is one of the strongest countries in global maritime business, in Sweden we can find cutting edge knowledge in maritime wireless communication and research. The maritime market is not just Nordic, it is global. We become stronger when we cooperate, which makes it easier to compete globally."

Full steam ahead in the face of the pandemic

So how does MAREN's collaboration platform work in practice?

As Pohjala says, "We are inviting our partners to a series of workshops, where we discuss what types of technology and infrastructure we should develop further. These workshops become the basis of a permanent network for this kind of dialogue, and also help companies and institutions to build new partnerships."

MAREN launched in April, and the first workshop will be held as a webinar during early autumn. Pohjala believes the project arrives at a very important time.

"The current pandemic has shown the value of the close contacts between Nordic countries. As business is opening up, there is a clear trend to use local suppliers, so in that sense this phenomenon may end up boosting our work at MAREN"

"This remains a great opportunity to develop Nordic cooperation," he concludes.



Lasse Pohjala, Senior Business Adviser, VASEK

Photo: VASEK

The Maritime Energy Transition

- Collaborative, Nordic platform solving challenges related to infrastructure and value chains in a zero-carbon maritime sector.
- Establishes a forum where stakeholders can work together to prepare the transition to a carbonless maritime sector.

- One of the pre-projects funded under the Nordic Innovation Mobility Mission: Sea Meets Land. The aim of the mission is to decarbonise Nordic ports, transport of people and goods – on and between sea and land. The most promising project will be selected for additional funding after the first project year.
- Runs from 2020-2021
- **Project partners:** VASEK, Fornybarklyngen, Rise and Erhvervshus Fyn

Reshaping the maritime industry with clean ammonia-based fuel

An innovative Nordic project is making strides towards hitting some ambitious maritime emission reduction targets. In a global economy ravaged by the COVID-19 pandemic, ammonia may offer a greener, better future for ships.

2050 is a crucial year for the world, but even more so for the maritime industry. By then, the sector must reduce emissions by at least 50 per cent, as per the UN's International Maritime Organisation. For such lofty targets to be met, the shipping industry needs to undergo a comprehensive change.

"This is one of the driving forces behind the NoGAPS project," says Kasper Søgaaard, Head of Research for the Global Maritime Forum. "Regardless of the consequences of the COVID-19 pandemic, global trade is expected to increase over the coming decades due to a growing and more prosperous world population. We need to reduce the carbon footprint of shipping dramatically, and this will require new very-low or zero-carbon fuels, such as ammonia."

Shipping currently accounts for approximately 2-3 per cent of global greenhouse gas emissions. The business at sea accounts for 940 million tonnes of CO2 emissions. If global shipping was a country, it would be the sixth-largest producer of greenhouse gas emissions.

Demonstrating that green ammonia can work as a shipping fuel is, according to Mr Søgaaard, an "important stepping stone" to hitting the 2050 mark. "The commercial viability of low carbon solutions for shipping is very much tied to governments providing the right regulatory framework. Fossil fuels will be cheaper unless the cost of emissions is factored in. For the transition to happen, the industry must establish that green solutions are safe, and can work in practice.

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It's imperative that we address these challenges, as doing nothing isn't an option. In the Nordic countries, we see that more industry stakeholders, as well as governments, are ready to invest in sustainable development. We need to double down!

Kasper Søgaaard, Head of Research for the Global Maritime Forum

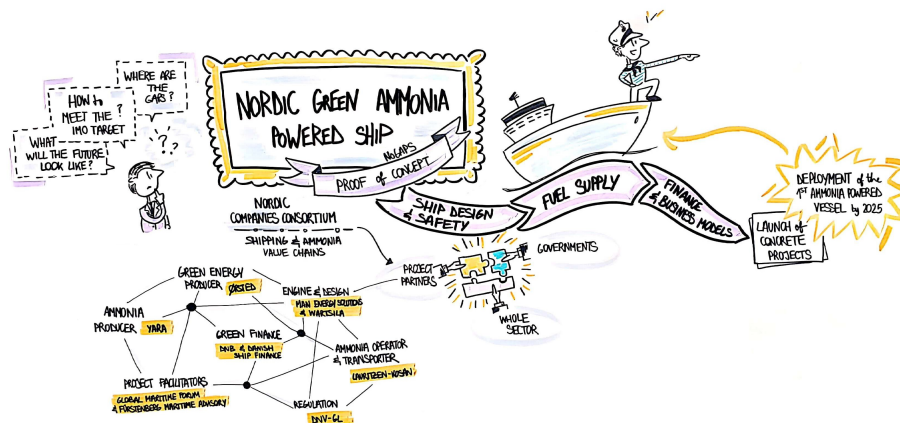


Illustration from the project's first workshop.

Illustration: Louise Dobler, Global Maritime Forum

A leading carbon alternative

The purpose of the NoGAPS (Nordic Green Ammonia Powered Ships) project is to harness the potential of a well-known commodity. Although ammonia is more commonly used for fertiliser and cleaning, its compound properties have placed it among the leading alternatives for a zero-emission fuel for the future.

"To fuel ships, ammonia-based fuel would be completely scalable to meet industry needs. We already have all the nitrogen we need. We also have enough untapped sources of renewable energy globally that, with the required investment in production facilities for renewable energy, can produce all the electricity and hydrogen needed."

According to Mr Søgaaard, it's only natural to wonder how the COVID-19 pandemic will impact the race towards zero-emission shipping. In the wake of such an unforeseen crisis, he predicts that opportunities for kickstarting a more sustainable future will arise.

"During a recent meeting, we asked some of the industry leaders in attendance if they thought progress would slow down due to the pandemic. The answer came in the form of a question: 'Do you think the climate crisis will go away because of this? No? Then why don't you just get on with it.'"

Such a blunt answer was all the confirmation Mr Søgaaard and the NoGAPS partners needed. As governments across the world are looking to create more jobs and get their economies back on track, many will be looking to build for long term prosperity.

"It's imperative that we address these challenges, as doing nothing isn't an option. In the Nordic countries, we see that more industry stakeholders, as well as governments, are ready to invest in sustainable development. We need to double down!"



Kasper Sogaard, Head of Research, Global Maritime Forum

Photo: Global Maritime Forum

What is green ammonia?

- Green ammonia contains no carbon, as it is produced electricity from hydrogen and nitrogen from the air.
- A leading alternative for a zero-emission fuel, ammonia has higher energy than pure hydrogen.
- More than 180 million tonnes ammonia is already produced annually, making it the world's fourth most produced compound.
- Ammonia-based fuel would require a lot less new infrastructure than other alternatives since it's already transported in large quantities.

In operation by 2025?

The first step for the NoGAPS project is to develop a proof of concept for their innovative ideas. Several crucial barriers must be overcome including safety, efficiency, sustainable supply chains, and commercial viability. However, the main players from the maritime sector, ammonia producers, technology experts that make up the NoGAPS partners, are confident they're on the right track.

The goal is to have a fully functioning green ammonia powered ship in operation by 2025.

The NoGAPS partners will take a holistic approach to the issue. They'll need to

provide new propulsion technology to be implemented in both new and existing ships and figure out the logistics of fuel provision. And just as important: demonstrate that ammonia can be commercially viable.

"Our preliminary work shows that having a vessel ready by 2025 is equally achievable as increasing green ammonia production. However, creating a commercially viable business case remains a challenge," Mr Sjøgaard admits. "This is where governments play an important part. Right now, there are no rules or regulations that allow the use of ammonia-based fuel. Governments must provide clear direction on where they want to go as a society."

If a sustainable shipping industry can be turned into viable business opportunities, Mr Sjøgaard says that "investors will follow."

Collaboration is key

Collaboration between different industries, sectors, and countries is key to opening up the seas for zero-emission ships.

Mr Sjøgaard recently took part in a study that showed 87 per cent of all decarbonisation investments are needed on land-based infrastructure, especially related to fuel production. This amounts to annual investments of 50 billion dollars. Whilst that is a staggering number on its own, considering global investments in energy exceeded 1.8 trillion dollars in 2018, Mr Sjøgaard does not see it as unfeasible.

"Everything is about the business case. Companies may have a hard time investing in expensive projects on their own, but for us to establish a carbon-neutral industry, we need to work together both across industries and with governments," Mr Sjøgaard says.

"Addressing climate change and developing alternatives to fossil fuels will not succeed unless we pull together."

Nordic Green Ammonia Powered Ships

- Developing a holistic proof of concept to showcase the necessary steps towards ammonia-powered vessels.
- Project running from 2020 to 2021.
- Based on the findings, the partners aims to construct a demonstration of a fully-operational ship powered by green ammonia by 2025.
- One of the pre-projects funded under the Nordic Innovation Mobility Mission: Sea Meets Land. The aim of the mission is to decarbonise Nordic ports, transport of people and goods – on and between sea and land. The most promising project will be selected for additional funding after the first project year.
- **Project partners:** Danish Ship Finance, Lauritzen Kosan, Wärtsilä, DNB, DNV GL, MAN Energy Solutions, Ørsted, Yara, and Furstenberg Maritime Advisory, with funding from Global Maritime Forum and Nordic Innovation.

About this publication

Towards Sustainable Revolution

Nordic Mobility in the Post-COVID-19 Era

Authored by NewsLab

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