

*Shipping goes*

# ELECTRIC

The shipping industry has great changes ahead  
going from pollution to solution.  
In Norway the upheaval starts with batteries.

# MILJØVENNLIG TRANSPORT VIA SJØVEIEN

Transport via sjøveien er vesentlig mer klima- og miljøvennlig enn veitransport, og har høy prioritet i arbeidet for å nå nasjonale og internasjonale klimamål. Color Line står for en stor andel av godstransporten til sjøs mellom Norge, Sverige, Danmark og Tyskland, og selskapet har investert betydelig i miljøtiltak.

## LANDSTRØMANLEGG

Color Line har vært en pådriver for etableringen av landstrømanlegg i norske havner med anlegg i Oslo, Larvik og Kristiansand. I 2016 fikk også Sandefjord havn tilskudd til utbygging av landstrømanlegg og dermed kan alle Color Lines skip innen kort tid koble seg på landstrøm, i alle norske havner der selskapet opererer.

## EKSOSGASSRENSESYSTEMER

For å møte lovpålagte miljøkrav har Color Line installert eksosgassrensesystemer for hovedmotorene på alle selskapets nye skip. Rense-

utstyret reduserer utslippet av svoveldioksider med over 90 prosent, og gir en årlig utslippsreduksjon av svoveloksid per skip på over 500 tonn. For rederiet samlet er reduksjonen cirka 2 500 tonn svoveldioksider per år. I tillegg har renseteknologien redusert utslipp av partikler som sot med cirka 50 prosent.

## PLUG-IN HYBRID

I januar 2017 signerte Color Line en intensjonsavtale med Ulstein verft om bygging av verdens største plug-in hybrid skip. Fergen med arbeidsnavnet «Color Hybrid» vil ha full batteridrift inn

og ut av fjorden med leveranse innen høysesongen 2019.

## I FRONT

Som ledende norsk rederi skal Color Line yte samfunnsansvar i møte med klimautfordringene, og ligge i front med innføring av ny og klimavennlig teknologi om bord på selskapets skip og i de havnene skipene ligger til kai. Miljø er en akselerator for Color Line, og selskapet har jobbet systematisk over tid for å møte klimakravene. Dette er selskapets viktige bidrag til det grønne skiftet.



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# The Times They Are A-Changin'

Bob Dylan wrote these words  
in 1963 - and he was right.

## ALONG WITH THE CHANGE COMES CHALLENGE.

A growing population and higher living standard come with a bigger footprint. The shipping sector is the embodiment of global trade. It is totally dependent on fossil fuels that hurt the climate, the environment and human health. Problems like ballast water, sewage, chemicals and pollutants also follow in the wake of the shipping industry.

At the same time, shipping is crucial to achieve the majority of the UN's Sustainable Development Goals.

So how can we solve these problems and decarbonize the fleet? There is no one answer to that question.

## The technology optimist's approach

The Bellona Foundation focuses on new technology, smart logistics and green harbors. The battery revolution hastened by electric cars is now hitting the maritime industry. Evidence can be found in Norway, onboard an electric ferry, a hybrid-electric fishing boat, a fjord sightseeing-boat and even supply ships. New contracts to build huge passenger ships with battery packages show that the green technology is a reality today.

250 million tons of fossil fuels must be replaced and I believe we must look to the ocean to find the bio mass needed. This is not only a challenge - it also contains great opportunities!

Within the next two years we will see a combination of electric propulsion and autonomous operation for short sea shipping vessels.

Renewable energy prices are rapidly declining, and the ships of tomorrow will be using multiple sources of energy, like batteries, hydrogen fuel-cells, LNG and biofuel.

## Reasons for optimism

Recent breakthrough in the IMO has made me optimistic about the future. In 2016 the IMO set a global limit for sulfur content in fuel oil to 0,5 % - one of the most comprehensive global regulations of air pollutants ever.

Both the Polar Code and the Ballast Water Management Convention will enter into force this year. This tells me it is possible to regulate international shipping.

## So what's next?

Though it is a part of everyone's footprint, international shipping was not included in the Paris climate agreement. Neither is The Polar Code strict enough; it does not state an absolute prohibition of heavy fuel oil in the Arctic. We also need a new convention for sustainable shipbreaking; The Hong Kong Convention has failed to improve the industry.

The regulations must be global and equal for all ships. Our challenge to the nations is to boost technology and make sustainable energy available.

We need to take the ocean into use - with care.

## SIGURD ENGE

MANAGER OF SHIPPING AND ARCTIC ISSUES





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Published by the  
Bellona Foundati-  
on, June 2017.

**DESIGN:** Amund Nitter.  
**EDITOR:** Ellen S. Viseth  
**CIRCULATION:** 3000

**THANKS TO:** Pål Laukli,  
Christian Rekkedal,  
Charles Digges, Anne F.  
Helseth, Pkom

**PRINTED BY:**  
Grøset Trykk AS



# Battery beats

There has been a rapid development in the Norwegian battery industry that sends **electrical impulses** through the whole of the shipping industry.

TEXT: INGVILD TELLE



2015

## AMPERE

- › **OWNER:** Norled
- › **SHIPYARD:** Fjellstrand
- › **WHEN:** In operation since January 2015
- › Ampere is not only Norway's, but also the world's first battery-powered car and passenger ferry. She carries up to 120 cars and 360 passengers between Oppdal and Lavik in Sogn og Fjordane. In a way her fate belongs to The Norwegian Public Roads Administration, who demanded that the stretch should be covered by a zero-emission ferry.

## KAROLINE

- › **OWNER:** Bent Gabrielsen
- › **SHIPYARD:** Selfa Arctic AS
- › **WHEN:** In operation since summer 2015
- › Karoline is the pioneering passion project of fisherman Bent Gabrielsen. Like Ampere, not only is she Norway's, but the world's first battery-driven fishing vessel. In her first year in operation she didn't lose one day out on the sea due to technical problems. Karoline has two battery packs of a total of two tons and a diesel power unit of 80kW. The boat is not only environmentally friendly, but is much less noisy than her sisters on the sea.



“Batteries will be well suitable for shorter distances, such as fjord cruising and for use in and out of the harbor.”

**JAN KJETIL PAULSEN**  
SHIPPING SENIOR ADVISOR,  
BELLONA

“**FORTUNATELY**, the decline in the offshore market occurred at the right time”, says Jan Kjetil Paulsen, senior advisor on shipping in Bellona.

The decline, he says, was in the zeitgeist of greener technology and political will. It also forced the innovators and engineers from the oil sector into greener markets.

How far have we come into the so-called battery revolution?

**FLEET** › You might say that January 2015 marks the start. That's when the world's first full-electric ferry “Ampere” was set into business in the Sognefjord in western Norway. With 34 departures daily, “Ampere” can charge her batteries on each side of the fjord.

The Norwegian Public Roads Administration has received a lot of credit for demanding “Ampere” to be

a zero emission vessel. Not only did their demand give developers motivation, it also gave them a market.

In the aftermath of “Ampere”, the county authorities have followed the success and ordered no less than 20 electric ferries. The goal is 50 electrical ferries in operation by 2021.

Jan Kjetil Paulsen believes that the maritime industry is ready for new solutions.

“Batteries are well suited for shorter distances, such as fjord cruising and in and out of the harbor. For longer journeys, we must find other energy carriers. Hydrogen can be one of the solutions”, Paulsen says.

**DEVELOPMENT** › “Norway is the center of the world in terms of development in the market”, says Erik Ianssen, owner of boat manufacturers company Selfa AS.

He is also the initiator of bringing the Canadian battery factory PBES to Trondheim. The battery factory has gone from 4 to 40 employees in less than one year and has an estimated turnover of 200 million kroner's. Another 30 people are being hired this year, the company can reveal.

With Rolls Roys, ABB, Siemens, Norwegian University of Science and Technology and PBES assembled in the same region, the battery industry not only boosts its own cells, but also local subcontractors. Examples of that are the companies Tromek and Noca, who deliver battery racks and circuit boards. They are, seeing a growing a local market. “The Norwegian maritime sector has

always been at the forefront of technology and development. Until now, ferries have been in focus, the next will be faster passenger boats”, says Ianssen.

“Good news for the environment, but does it pay off economically?”

“Yes! Not only is electricity much cheaper than diesel, there are also much lower maintenance costs on the boats. There are, among other things, less vibration and less soot. The quality of the product is therefore far better over time”, says Ianssen.

**INDUSTRY** › The latest battery news came in the beginning of May 2017, when Siemens revealed that they would develop and manufacture battery systems ›



2018

### HURTIGRUTEN'S HYBRID SHIP

- › **OWNER:** Hurtigruten AS, developed by Rolls Roys and Bellona
- › **COAT:** Kleven yard
- › **WHEN:** Put into operation July 2018
- › Hurtigruten's new hybrid ships will sail in cool polar waters, and will switch to electrical operation as they sail through vulnerable areas. In total, these ships will contribute to 20 percent less emission, and become a milestone regarding battery solutions on large ships. Overall, it is estimated that the two vessels reduce emissions by 6400 tons of CO<sub>2</sub> each year.



### VISION OF THE FJORDS

2016

- › **OWNER:** The Fjords
- › **SHIPYARD:** Brødrene Aa
- › **WHEN:** In operation since July 2016
- › When you first lay glance on Vision of the fjords, you might be a bit confused. Is she a boat or is she a piece of architecture? Well, she is both, and for that she was entitles Ship of the Year 2016. The idea behind the passenger-friendly and aesthetic tourist ship is that one is able to walk stairlessly around the whole ship, giving great view. The engine itself is a hybrid solution consisting of two 150 kW electric motors and two diesel generators of 749 kW, and a 600kWh battery pack.



2019

### COLOR LINE'S NEW HYBRID SHIP

- › **OWNER:** Color Line
- › **SHIPYARD:** Ulstein Shipyard
- › **WHEN:** Put into operation in the summer of 2019
- › The stretch between Sandefjord and Strømstad will never be the same after the summer of 2019. By then the world's largest hybrid ships will be on route, ensuring 2000 passengers and 500 cars to go on an environmentally friendly holiday in their neighboring country. The ferry will be charged with renewable electricity from its own landing facility, including an on-board generator.



- › in their factory in Trondheim. The company develops battery systems for both the oil and gas industry and the maritime industry in Trondheim.

"This means that the Norwegian maritime cluster, as of today, is the most dynamic and most complete in the market", says Odd Moen in Siemens.

He believes that more competition in the market will create better solutions for the industry and better products. So far, Siemens has delivered solutions to 30 boats. Moen believes that their pioneer boats, such as Ampere, have proved that batteries are indeed the future.

"At this point we have to make sure that the in-

**“Not only is electricity much cheaper than diesel, there are also much lower maintenance costs on the boats.”**

**ERIK IANSSEN**  
CEO, SELVA ARCTIC

dustry move further and that we take advantage of all of the opportunities we can get, so that the maritime sector of Norway keeps its position as competitive", he says.

**COLLABORATION** › In about a year Hurtigruten will launch a new environmental friendly cruise ship, designed in collaboration with Bellona. It will be the first of its kind, and will sail in both arctic waters and on Chilean fjords.

"MS Roald Amundsen" will be a perfect match to the fast growing global demand for sustainable adventure travel. The guests care about sustainability and the industry should too, says Daniel Skjeldam, CEO of Hurtigruten.



The ship will accommodate 530 passengers and it will take the shipping industry a great leap towards being sustainable and battery powered.

"Sustainability is the core of every detail of the ship and the on board operation. The hybrid engines will reduce fuel consumption substantially and allow for periods of completely emission free sailing", Skjeldam says.

**THE FUTURE** › In other words: Things are moving fast. In 2015 Bellona and Siemens published a feasibility study showing that seven out of ten ferries along the Norwegian coastline would be profitable with electrical operation. Most of the ferries that were suggested built as hybrids two years ago, can

**“The guests care about sustainability and the industry should too”**

**DANIEL SKJELDAM**  
CEO OF HURTIGRUTEN

now be made fully electric.

Big Norwegian yards such as Kleven, Ulstein, Fiskarstrand and Havyard are all building boats with battery solutions.

"The maritime sector enjoys benefits from the huge changes in the automotive industry, and will continue to develop in a rapid pace", says Jan

Kjetil Paulsen.

Modern battery solutions mean you can use renewable energy in a wide range of areas where it has not been possible before.

"But to get there, the authorities need to spend more money on infrastructure and make green requirements when granting concessions".



Credit: Sverre Hjørnevik

## The future of the marine industry with sustainable vessels.

ABB technology enables a spectacular ferry to run silently on batteries along UNESCO listed Nærøfjord in Norway. ABB provides integral technology to one of the most innovative ship designs ever seen on the Norwegian fjords. The ferry will couple its striking appearance with ABB's cutting edge maritime hybrid solution. ABB's award winning Onboard DC Grid system will manage and control the energy flow between the diesel engine, propeller and charging station. The cruise ferry is owned by The Fjords. [abb.com/marine](http://abb.com/marine)



## “The rapid change of shipping requires us all to think differently”

Director of Nor-Shipping, Birgit Liodden, is entering the board of the Bellona Foundation.

BY: ANNE FOUIGNER HELSETH

A high school dropout who stumbled into shipping by chance, Nor-Shipping Director Birgit Liodden has always stood out in the industry.

When awarded the Wista Leadership Award, she was named “A spokesperson for the new shipping generation”. This new shipping generation, in Liodden’s view, should be nothing but green.

“I’m in it for creating change towards a sustainable maritime industry that people can be proud of,” Liodden says, explaining why she negotiated a sustainability mandate when offered the position as Director of Nor-Shipping.

### Cluster potential

Liodden believes that the maritime industry can draw from its entrepreneurial mindset.

“A number of interesting alliances and initiatives are now being formed around our industry,” she says.

In the Disruptive Sustainability Hall at Nor-Shipping you’ll find anything from a cleantech cluster to LNG alliances and a digital transformation platform.

“It’s of key importance to realize the potentials held by digital transformation. Any established corporation needs to appreciate the supplements from new en-



**IN IT FOR THE CHANGE:** Birgit Liodden set sustainability work as a term when becoming Director of Nor-Shipping. PHOTO: NOR-SHIPPIING

trepreneurial actors, as the rapid change of shipping requires us all to think differently“.

### Sustainability as business

Liodden is a firm believer in sustainability as hard core business.

“I believe that we need to optimize the silo-crushing cooperation between NGOs and business,” she says.

With that viewpoint, she should fit right in when now entering the board of Bellona, with its track record of developing financially viable environmental solutions in conjunction with the industry.

“Bellona has been a frontrunner on understanding that you can create change through partnerships, and that guiding corpora-

tions in pragmatic ways built on a business mindset works better than just pointing fingers at them,” Liodden says.

### Walking not talking

She strongly believes in the potential and will of the maritime industry, yet is not afraid to point out how “greenwashing” and hype terms make the work harder for the actual pioneers.

“These days, you struggle to find articles not mentioning sustainability phrases, and there will be actors who talk more than they walk. Thus, the role of watchdogs like Bellona, who ensures that the industry is held accountable and keeps pushing for real change, is key.”



# Plastic

NOT SO FANTASTIC FOR COD

Trillions of tiny plastic particles have become unwelcome ingredients in the marine food chain. Bellona joins scientists in three countries to study the effects of micro plastics on cod in Norwegian coastal waters. ▶

TEXT: MARIANNE ALFSEN/FELIX MEDIA

› **EACH YEAR**, more than eight million tonnes of plastic end up in the oceans. That equals dumping a garbage truck of plastic every single minute. If we keep it up, there will be more plastic than fish in the sea by 2050, according to UN Environment (UNEP), quoting a report from the Ellen MacArthur Foundation.

Rotating currents between California and Hawaii have caused enormous amounts of plastic to form a growing garbage patch so large, that it will soon be visible from space. However, “The great Pacific garbage patch” is merely the tip of an iceberg constituting a ticking time bomb – as all plastic in the ocean is slowly ground down into micro plastics, which takes decades, even centuries, to degrade.

**INVISIBLE, BUT NOT GONE** › “The fact that we can’t see it any more, doesn’t mean it is gone,” says senior aquaculture adviser Anders Karlsson-Drangsholt in Bellona.

51 trillion micro plastic particles, 500 times more than there are stars in our galaxy, litter our seas. In addition to particles from degrading plastic matter – such as bottles, bags and fishing nets – the ocean is also at the receiving end of micro plastics used as ingredients in scores of products.

“Most of us use products containing micro plastics every day, such as cosmetics and toothpaste. In addition, micro plastics are released when we for instance wash our fleece jacket, and – when we drive – from the tyres of our cars. Ultimately, it ends up in the marine food chain and potentially on our plates,” says Karlsson-Drangsholt.

**PLASTICOD** › “The trouble is, we don’t really know the effect micro plastics in marine food has on the fish that digest it,” he adds.

To close the knowledge gap, Bellona joins forces with scientists from The Norwegian Institute for Food, Fisheries and Aquaculture (Nofima) and The University of Bergen, as well as Aarhus University in Denmark and Wageningen University & Research in the Netherlands. The Research Council of Norway has put the necessary money on the table.



“The trouble is, we don’t really know the effect micro plastics in marine food has on the fish that digest it.”

ANDERS KARLSSON-DRANGSHOLT  
SENIOR AQUACULTURE ADVISER, BELLONA

PHOTO: KARI TORP/BELLONA

**HANDS ON:** Anders Karlsson-Drangsholt, senior aquaculture adviser in Bellona and eager freediver, on his way to place bags of micro plastics at a crucial spot in the Oslo Fjord.

The four-year PlastiCod project – “plastic-in-cod” – will study what happens when cod in Norwegian coastal waters digest micro plastics.

**HAZARDOUS SUBSTANCES** › “Micro plastics in it self is not necessarily a hazard to cod health, or human health for that matter. We use plastics in tooth fillings, for instance. However, micro plastics are highly fat-soluble and are known to absorb hazardous substances, such as PCB and dioxins,” explains Karlsson-Drangsholt.

In 2016, the PlastiCod partners placed small bags of micro plastics in nine locations along the entire Norwegian coastline, to find out which and how much hazardous contaminants it absorbs.

This year, the scientists will mix the naturally contaminated micro plastics into feed pellets, and feed it to farmed brood stock cod – to study how micro plastics and contaminants affect digestion, health,

reproduction and also roe and larvae development, and ultimately if it can cause decreasing stocks.

The project will also study cod larvae and their food, zooplankton, to find how micro plastics affect the cod food chain.

**OF INTERNATIONAL IMPORTANCE** › “This project will provide new knowledge about how micro plastics affect food quality, which is an important word in this context,” adds Andre Sture Bogevik, researcher at Nofima and head of the PlastiCod project.

The results may also provide valuable insight into how micro plastics affect other marine species, that are dependant on similar food chains.

“In order to fix a problem, we need to find out if there is one, and how big it potentially can become. Only then, will we be able to invest our resources in the right place”, adds Anders Karlsson-Drangsholt in Bellona.

## FACTS: PLASTICS IN THE OCEAN

- › Each person living in Western Europe consumes 100 kg of plastic each year. 8 million tons find its way into the ocean annually.
- › All plastics in the ocean will eventually be grinded into microplastic that can be taken into the food chain.
- › The biggest source of microplastic in Norway is wear and tear of car tires. Artificial grass fields and boat paint are also significant sources.

## BELLONA’S PLASTICOD PROJECT

- › Joint research project that will examine how much toxins that absorb in the plastic.
- › In 2016 the Bellona Foundation placed bags of micro plastics in the sea in nine different places along the Norwegian coast (see map). It was later collected and sent to the University of Aarhus, Denmark, for analysis.
- › Step two is to feed the plastic to cod and see if or how the fish is affected.
- › Researchers will focus on both fish and larvae with a particular focus on fertility.



# Captain Climate

“It gives me much pleasure to be in areas where the sea is clean. It’s a reminder of what we are fighting for,” says Bellona manager Frederic Hauge.

TEXT: INGVILD TELLE ~ PHOTO: PÅL LAUKLI

“Do I find peace at sea? Yes, especially in a storm from hell,” the 51-year-old Frederic Hauge laughs. Sipping a cup of coffee, he looks out toward the dock at Bygdøy in Oslo, where the Bellona’s *Kallinika* is moored. It smells of the sea and engine oil in the hot spring sun.

“No, at the sea I find the extremes. It’s the world’s most harmonious place when it’s calm, but when it breaks out, it’s total chaos,” he smiles.

The glance reveals an experienced sailor: Even at port in the Oslo Fjord, Bellona’s leader sees the horizon far ahead. He sees opportunities for cooperation. He games out politics and detects environmental crime. He can smell a storm from afar, and truth be told, it’s often he who sets them off. And he uses his sailor’s wits to navigate the swells of the media like the swells of the sea.

## Foundation and victory

Frederic was 12 years when he decided to fight for nature. Aboard his uncle’s fishing boat in Lofoten, he was overwhelmed. Nature. Birdlife, colors, the precipitous mountains. The abundance of life in the air, on land and at sea. Lofoten made an indelible impression. But the breathtaking panorama also inspired uneasiness. The battle for the Alta waterways has been lost and the Ekofisk field was about to shackle Norway to the fortunes of the oil industry.

Frederic enrolled in Nature and Youth as a teenager, and not long after found himself in Jøssingfjord standing off against the Titania mining company, which was fouling the Fjord, in only a rubber dingy. The activists were worried mining chemicals would drift out of the fjord and lead to wider contamination. They fought for 11 years, and Titania’s waste was finally put in landfills. Halfway through the battle, Hauge founded Bellona in 1986.

“Having a boat allowed us to be in the field, and very often things look very different in the field than they do in reports,” says Frederic.

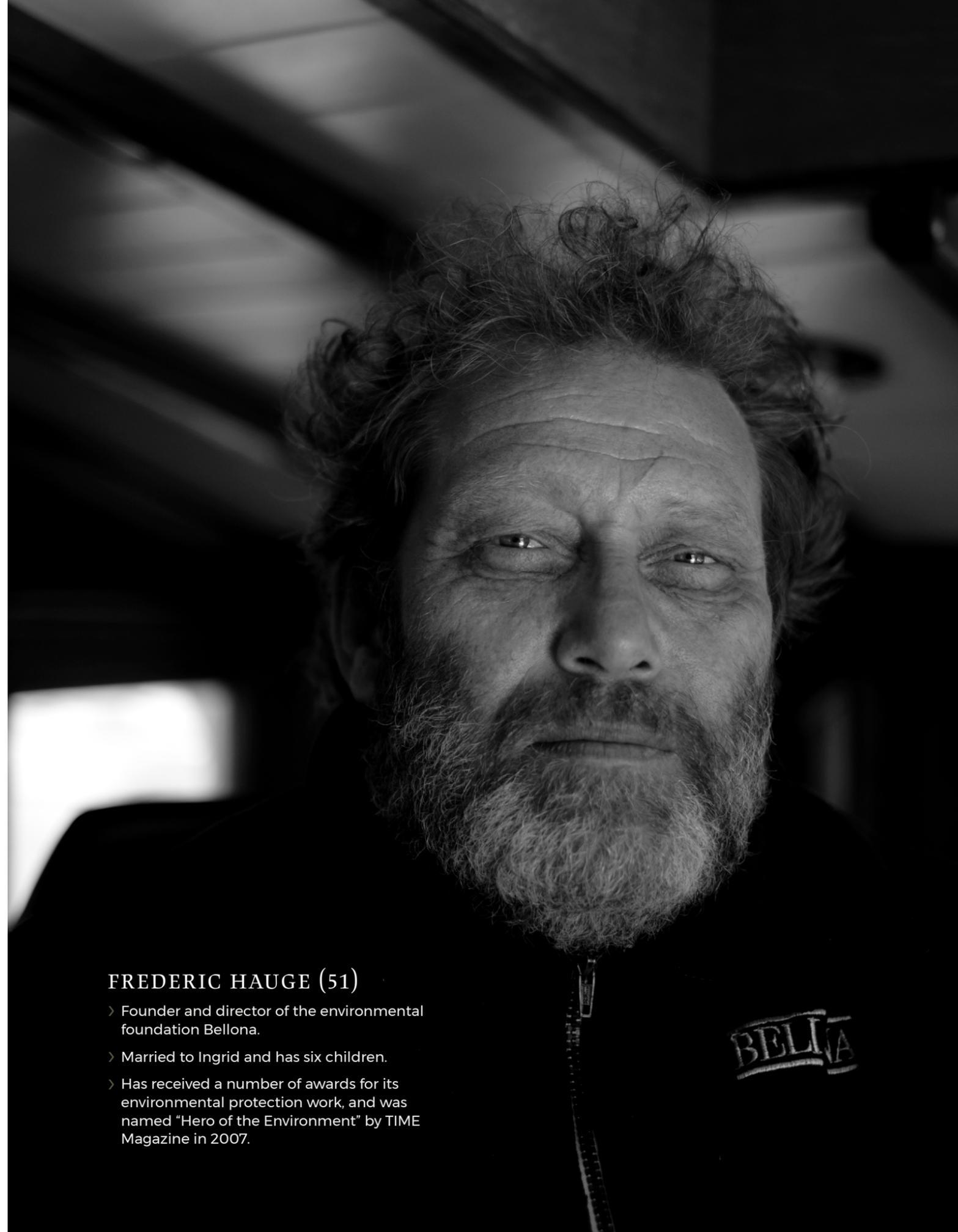
All through the Titania case, researchers claimed there was no current in the fjord strong enough to carry mining waste further afield. But local fishermen said that, often enough, they would lose nets to the currents. As it turned out, the researchers’ measuring instruments were clogged with sludge.

“To have a boat is to be able to be present. It has given us a unique way to build networks. *Kallinika* is a floating district office,” smiles Frederic.

Today, Bellona has a staff of 48 throughout offices in Oslo, Brussels, Murmansk and St.Petersburg. In addition, Bellona is co-owner of several companies working for environmental solutions.

## The power of the example

Frederic learned early that you couldn’t solve the world’s environmental problems by railing against



## FREDERIC HAUGE (51)

- > Founder and director of the environmental foundation Bellona.
- > Married to Ingrid and has six children.
- > Has received a number of awards for its environmental protection work, and was named “Hero of the Environment” by TIME Magazine in 2007.



*“Having a boat allowed us to be in the field, and very often things look very different in the field than they do in reports.”*

**FREDERIC HAUGE**  
DIRECTOR OF BELLONA

## BELLONA'S BOATS



### M/S BELLONA

The first Bellona boat M / S Bellona joined the journey from Moss to Kristiansand to drive relationship building and to research the environmental situation along the coast. This was in 1986, and onboard were both divers and sampling equipment. When she arrived at Kristiansand, the engine quit, and the environmentalists received support from the business community to repair her.



### M/S GENIUS

Boat number two, M/S Genius, was put into operation in 1990 and immediately sailed to the Novaja Semlja, where the Soviet Union carried out nuclear testing only 90 km from Norway. Bellona's protest drew attention to the problem.



### M/S KALLINIKKA

The ink was hardly dry on the M/S Kallinika, before she was sailed up to Røst in Lofoten. This was in 2001 and Bellona protested against Hydro's exploration drilling in the northern areas. As a result, all activities were postponed pending the management plan for Lofoten and the Barents Sea. There has been no drilling in the Lofoten area ever since.

growth and development. Instead, Bellona found that working with businesses led to better solutions. Soon, companies like Statoil, Shell and Lerøy were contacting Bellona to ask for help.

“It is extremely motivating and, not the least, cool to see that it is no longer just the big companies that invent new things. Access to knowledge means that many more can participate and innovate. There is a lot of competence to be found in Norway.

”Would you say that you are optimistic that Norway will be a low-carbon society?”

”Yes, in many areas. But today we do not have the political understanding of what measures will be taken. There is a reason why we spend more time with business than with politicians. But at the same time we depend on politicians who dare to declare the extent of the challenge – and who take the time to get into the fact sheets when making solutions,” says Hauge.

”Why does Bellona work so much with the maritime and marine sectors?”

”Because it is one of the places where we can, by the power of example, create a precedent that matters. If Norway is very good at organic carrot cultivation, it may not be the world's hottest trend. But what Norway does on maritime industry, it sets a trend,” Hauge says.

”It's also an area where there is an opportunity for great value creation. It's 12 years to 2030. There may be 20,000-25,000 boats that need to be rebuilt to reduce their carbon footprint, and that represents a huge opportunity for the Norwegian shipbuilding industry. This sector has the capacity to do great things.”

### An ongoing struggle

At seventy-nine-feet, and with two masts and a hull of rolled and welded carbon steel, Bellona's boat, the *Kallinika*, is built on an idea that she will always return home. On her maiden voyage in 2001, she helped to stop exploration drilling outside Røst in Lofoten. This gives Hauge something to be proud of.

“When Frederic is at sea, he changes character and lowers his shoulders in a completely different way than he does elsewhere,” says the *Kallinika*'s second in command, Sigurd Enge.

Perhaps it's the isolation of being at sea. Maybe it's the lack of cell phone coverage. Or maybe it's the golden opportunity to fish. Probably a combination.

“I usually have a schedule when I get on the boat, and I like to stick to that schedule,” says Sigurd. “Frederic, on the other hand, would rather fish. It is an eternal struggle.”

”Frederic also has a physical side that comes out

when he is on a boat. He likes to use his body on practical work, and I think I have a positive impact on him. It can also be easier to put things in perspective when you see it from a boat. Perhaps that's why he is so attracted towards the ocean,” suggests Sigurd.

When not at sea, Hauge's phone is always ringing. He charges it five times a day. He is the link among lots of people who can connect and create change in the maritime sector.

”I think a lot about how we can electrify the maritime sector to become a zero-emission industry. We need to get things to work better,” says Frederic, and then falls silent for a bit.

”And then there's the whole debate about the Gulf Stream and what happens if we actually endanger it. I'm a little afraid it has already started. You do not mess with the Gulf Stream. Just that, I really want to say to Prime Minister Erna: You do not mess with the Gulf Stream.”

This comes extremely clear at sea. The world is beautiful and harmonious if we manage to live in balance with it, but so incredibly devastating if we mess with it. Heaven and hell. Frederic steer towards the first.

- It just has to work. Failure is no option.



**TOXIC:** Scraped ships contain asbestos, heavy metals, oil and biocides. The toxic material pollutes the beaches, kills surrounding vegetation and gets washed out in the ocean by the tide.

PHOTO: NGO SHIPBREAKING PLATFORM



**DEADLIEST CRAFT:** Workers at the shipbreaking yards are exposed to hazardous fumes and materials, and most of them lack protective equipment.

PHOTO: NGO SHIPBREAKING PLATFORM

# Time to get off the beach

128 ships were scrapped on South Asian beaches during the first quarter of 2017. Norwegian shipping and investment companies are taking the lead to change the dangerous and environmentally hazardous practice.

TEXT: MARIANNE ALFSEN/FELIX MEDIA

**THE IMAGE IS WELL KNOWN:** workers, some of them just children, with minimal protection and only pennies on their pay check, rip massive ships apart with their bare hands on Asian beaches.

The shipbreaking beach yards in Alang in India, Gadani in Pakistan and Chittagong in Bangladesh have earned the title of the world's most dangerous working places. In the first quarter of 2017 alone, at least 11 workers paid with their lives. Five of them

died in a fire at the Gadani shipbreaking yard. Others were crushed by falling equipment and steel plates, according to NGO Shipbreaking Platform. In addition the lack of adequate recycling and waste handling practices causes massive environmental and health damage.

“Beaching of ships for scrapping is the ugly and dark side of the shipping industry,” says shipping adviser Sigurd Enge in Bellona.

A common practice among ship owners is to conceal the identity of the vessel and sell it to ship breaking yards via middlemen, known as “cash buyers” – in an attempt to protect their reputation.

**BLIND ALLEY** › Most ships destined for scrapping are beached – 668 of a total of 862 in 2016 – as efforts to create international regulations have failed miserably.

Only six countries have ratified the 2009 IMO Hong Kong Convention that set standards for safe

and environmentally sound ship recycling. To be implemented, 15 countries holding 40 % of the world fleet and the major shipbreaking countries must ratify, which is not expected to happen any time soon.

“The Convention is nothing but a blind alley. It does not address downstream waste management, labour rights or environmental justice. It does not even ban beaching, overlooking the obvious, that a beach is not suitable for hazardous, high-risk industrial activity,” says Sigurd Enge.

**DUBIOUS COMPLIANCE** › Danish investigative journalists have revealed precarious conditions at a yard that has received a Statement of Compliance with the Hong Kong Convention.

“That should prompt serious questions as to



“Beaching of ships for scrapping is the ugly and dark side of the shipping industry.”

**SIGURD ENGE**  
SHIPPING ADVISER, BELLONA

whether the Convention is equipped to ensure safe and environmentally sound ship recycling”, agrees Ingvild Jenssen, Director and Founder of the NGO Shipbreaking Platform in Brussels, where Bellona is one of the members.

“The fact that scrap dealers specialized in trafficking waste ships to the worst yards are the strongest proponents of the Convention, should also prompt concerns,” she continues.

Cash buyers use flags such as Comoros, Niue and Palau, known for their anonymous post-box companies and

poor implementation of international maritime law, to avoid accountability.

“Who believes that the worst performing flags and cash buyers benefitting from the worst shipbreaking conditions will ensure improvements?” asks Jenssen.

► **PROFIT BEFORE ETHICS** › “Ship owners have been aware of the detrimental effects of breaking ships on tidal beaches for more than 20 years. Yet the ease, with which existing environmental laws can be circumvented for the sake of the extra profit, allows the worst practices to persist,” continues the Director of NGO Shipbreaking Platform.

The EU has banned beaching of all EU-flagged ships and is currently making a list of approved ship recycling yards globally. China, the United States and Japan have also banned beaching as a method. But local and regional rules are easily flagged around, particularly as the industry has fallen on hard times.

European companies accounted for half of the vessels beached in South Asia the first quarter of 2017 and where involved in many of the fatal accidents. Greece topped the list. Yet even the Danish shipping giant Maersk, who previously advocated for sounder practices in modern facilities, resorted to beaching in 2016. As did 99 percent of obsolete German ships.

“For want of effective regulations, we are dependent on the industry taking action. Norwegian companies like Höegh, Wilhelmsen and Grieg Star are among those leading the way, and the Norwegian Ship Owners’ Association was first to recommend to its members not to resort to beaching,” says Sigurd Enge.

**GRIEG ON THE BARRICADES** › “We simply want to be a responsible business,” says Eli K. Vassenden, COO for Ship Management in Grieg Star.

For many years, the company has had strict policies on ship recycling that go far beyond the Hong Kong Convention. However, Grieg Star has bigger ambitions than just tending to their own back yard.

2010, the company established Grieg Green, a subsidiary designed to help clean up the industry’s shady shipbreaking practices. Grieg Green acts as a green middleman, buying ships destined for scrapping at competitive prices, reselling them to yards with sound recycling practises.

Worldwide, there are approximately 300 demolition yards. Less than 10 % have acceptable environmental and safety standards, according to Grieg Green. And their capacity is currently underutilised, according to NGO Shipbreaking Platform.

“Grieg Green has contributed enormously by working closely with the prequalified yards, to improve their methods and standards,” says Vassenden.

All ships are closely monitored throughout the process, and Grieg Green provides a detailed report after recycling is carried out.

#### FACTS: NORWEGIAN SHIPS ON ASIAN BEACHES 2016-2017

- › Even a country holding the torch as high as Norway, has its black sheep: 12 Norwegian ships were beached in 2016, six in the first quarter of 2017.
- › Worldwide, 196 ships have been broken in the first quarter of 2017, mainly in Bangladesh, India, Pakistan, China and Turkey.



The shipping industry is facing a tough market, but Vassenden does not fear a backlash to the progress that – after all – has been made.

“There is an unprecedented focus and will, a result of increasing pressure from for instance NGOs. We are not the only ones who want to act responsibly,” says Vassenden.

“Grieg Star will continue to climb the barricades as often as we can,” she continues.

**SOUND INVESTMENTS** › The Norwegian investment company KLP joins Grieg Star on the barricades. In 2016, they commissioned a report on shipbreaking practices worldwide, looking at the issue from an investor’s viewpoint.

“Norway is one of the leading maritime nations and as a Norwegian investor it is only natural that we take an interest,” says Annie Bersagel, Acting head of responsible investments. KLP is a pioneer in ethical investments in Norway and excluded their first companies on ethical grounds in 2002.

“The easiest would be to simply remove the com-

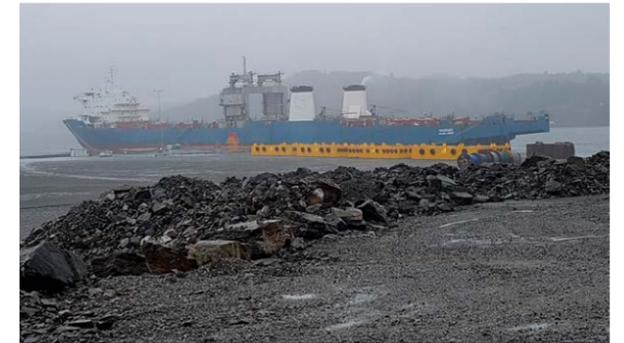


“To change the entire business, we need international regulations that are impossible to flag around.”

**ELI K. VASSENDEN**  
COO FOR SHIP MANAGEMENT  
IN GRIEG STAR

panies that beach ships for recycling from our portfolio, but we want to do more. We want to contribute to change,” says Bersagel, who agrees that the industry must take the lead, as the international community fails to agree on common regulations.

“Good intentions and local rules can only take you this far. To change the entire business, we need international regulations that are impossible to flag around, and make it impossible to hide behind cash buyers and middlemen,” adds Eli K. Vassenden in Grieg Star.



**ARRESTED:** Norwegian authorities uncovered a one-way insurance policy, indicating the ship was actually on its way to Pakistan. Illegally stored sludge was found on board. PHOTO: NORWEGIAN ENVIRONMENT AGENCY

## Ship arrested in Norway

A tipoff from Bellona and NGO Shipbreaking Platform led to the first ever arrest by Norwegian authorities of a ship destined for beaching.

“Tide Carrier” (now named “Harrier”) formerly owned by the Norwegian company Eide Marine Eiendom AS, was arrested in April as it attempted to leave the country for beaching and scrapping at the Gadani yard in Pakistan. The ship was sold to Julia Shipping Inc and Nabeel Ship Management LTD is the current operator.

The operator claimed that the ship was on its way to Oman for repair, but the authorities uncovered that the ship has a one-way “Break Up Voyage” insurance policy.

The Norwegian Environment Agency also found waste containing oil in the ship’s tanks.

“We have reported Julia Shipping Inc and Eide Marine Eiendom AS to the police for attempting illegal export of waste,” confirms Einar Knutsen, Head of Section for Industrial and Offshore Control in the Norwegian Environment Agency.

The basis for the arrest is the 1992 Basel Convention, controlling the movement of hazardous waste across international borders.

“This ship is waste and has also has waste on board. It will not be allowed to sail until we are sure the ship will not be scrapped illegally, and that all waste will be treated properly,” states the Agency’s Director General, Ellen Hambro.

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# The future of the fjords

This summer, more cruise tourists than ever will visit Norwegian fjords. To make the World Heritage fjords zero-emission, is not only a necessity, it is a business opportunity.

TEXT: MARIANNE ALFSEN/FELIX MEDIA

**IT IS A CLEAR SUMMER DAY**, the skies are deep blue, but in the World Heritage listed Geirangerfjord, the fumes from the cruise ships, sightseeing boats, ferries and other fossil-powered vessels visibly cloud the spectacular views; steep and snow capped mountains, shooting straight up from the dark, deep waters of the narrow fjord – described by UNESCO as “among the most scenically outstanding landscapes in the world”.

However, there is a fly in the ointment:

“Smog filled fjords has become an all too common scenario. It is time we make our World Heritage fjords zero-emission, and recognize that it is a business opportunity,” says senior shipping adviser Jan Kjetil Paulsen in Bellona.

**WHEN IT ALL BEGAN** › There are hundreds of fjords along the coast of Norway. Two fjords of particularly pristine beauty and natural importance, including the surrounding mountain landscapes, were awarded World Heritage status in 2005: The West Norwegian Fjords of Nærøfjord north of Bergen, and the Geirangerfjord a bit further north. Since, tourism has soared.

This summer, record breaking numbers of cruise tourists will head for Norway – more than 3 million in total, a 13 % increase since last year. In Geiranger alone, where the population numbers a mere 238 souls, the number of cruise passengers has increased from 140,000 in 2006, to an estimated 310,000 in

**SILENT TOURISM:** The hybrid plug-in catamaran “Vision of The Fjords” mimics the winding mountain roads in the area. When going electric, it is silent and emission-free.

PHOTO: THE FJORDS DA)

2017. On the busiest days, more than 10,000 people come ashore. About 200 cruise ships are expected to pass through the Geirangerfjord this summer.

“Gold mine in the fjords” and similar enthusiastic headlines have dominated the news the past decade.

“Almost everyone has cheered the development, turning a blind eye to the fact that the financial upside has an environmental downside,” says Paulsen.

**FREE-FOR-ALL** › Today, there are no restrictions on the number of cruise ships that can enter the World Heritage fjords, nor any particular environmental requirements – be it cruise ships or local vessels – apart from general IMO and EU regulations.

At the beginning of May 2017, The Norwegian Maritime Authority presented a new report on the impact of cruise ships visiting World Heritage fjords.

“Surprisingly, hardly any cruise ships discharged sewage into the fjord, even though they can. NO<sub>x</sub> emissions, however, represent a real challenge,” confirms Bjørn Pedersen, Head of the Department of Legislation and International.

The report states that NO<sub>x</sub> emissions in the World Heritage fjords at times reach levels that are hazardous to health, and that the combination of NO<sub>x</sub>, soot particles and water vapour often cause clouds of smoke.

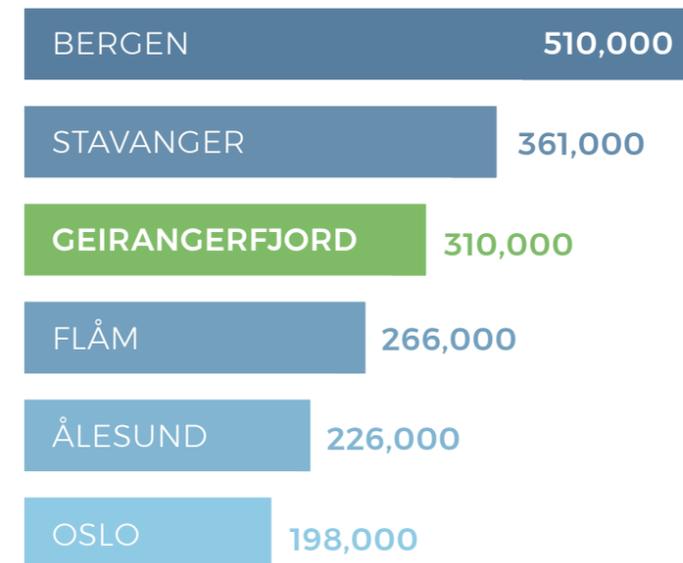
The report also shows that more than half of the cruise ships visiting Geirangerfjord and Nærøfjord ➤

**SMOG ON THE WATER:** 310,000 people are expected to visit the Geiranger Fjord in 2017. The extensive air pollution from the cruise ships is above the threshold for health damage. PHOTO: LUIS DAVILLA / SCANPIX



**FACTS: CRUISE TOURISM ON THE RISE**

Norway's most popular cruise destinations have almost reached their limits. 2017 is expected to beat the record, with a 13 percent visitor increase.



SOURCE: CRUISE NORWAY

are more than 20 years old, and thus not even bound by the latest international NO<sub>x</sub> emissions limits from 2000.

“We can absolutely control what type of vessels we want in our fjords, and it is fair to expect that it will be done,” says Pedersen, suggesting that the cruise report might prove a step in the right direction.

The report suggests several measures, such as regulating the number of ship calls, cruise ship size, and NO<sub>x</sub> emission levels allowed.

**PROFITS FIRST** “So far, however, local business and labour interests seem to have trumped any other concerns,” comments Jan Kjetil Paulsen in Bellona. “Since we don’t make any requirements, we get what we get. If we continue in this way the ones who do, such as California and Alaska, will get the greenest cruise ships in the market, while we are stuck with the rest”.

However, local zero-emission believers have begun to raise their voices – and see the business potential in going green.

One of them is Arne Sandnes, Mayor of the municipality of Norddal, one of two municipalities in the World Heritage Geirangerfjord area.

“Awareness is on the increase, but hardly any tangible measures have been implemented. This is one of the reasons why we propose a green harbour in Valldal,” says Sandnes.

The Mayor’s idea is to build a large harbour, where cruise ships can connect to renewable shore power, instead of running their diesel engines while anchored in the fjords. Tourists will be transported to the surrounding World Heritage area by local electric vessels. His vision includes hydroelectric powered tourist busses, ferries and other local means of transport.

**IDEAL LOCATION** Valldal is outside the defined boundary of the World Heritage area, the fjord is deep and – most importantly – there is abundant



“We can absolutely control what type of vessels we want in our fjords, and it is fair to expect that it will be done.”

**BJØRN PEDERSEN**  
HEAD OF THE DEPARTMENT  
OF LEGISLATION AND  
INTERNATIONAL

renewable energy available from the hydro power plant at Tafjord, further into the fjord. The high voltage line passes only one kilometre from the proposed harbour.

“This makes shore based power technically and financially feasible. The estimated cost is in the neighbourhood of 100 million NOK, a fraction of what it will cost elsewhere in the area.”

Bellona supports the idea of green harbours as a basis for developing zero-emission transport and new business opportunities in the World Heritage area – proposing an environmental triangle, with green harbours at Valldal, Stranda and Hellesylt.

“National authorities must facilitate the power infrastructure,” emphasises Jan Kjetil Paulsen.

The Mayor in the municipality of Norddal agrees.

“We are not able to shoulder the infrastructure cost alone,” Sandnes says, adding that national and

regional authorities have a vested interest in the protection of the World Heritage fjords.

“We have, as a nation, committed to protecting the UNESCO listed fjords. If we fail, we may lose our World Heritage status. That would be an incredible tragedy for Norway as a whole,” he continues.

**INNOVATION NECESSARY** Infrastructure is an important piece of the puzzle, as is vessel innovation. In the Nærøfjord area further south, regional entrepreneurs have collaborated to build the world’s first hybrid plug-in carbon fibre catamaran, specially designed for sightseeing in Norwegian fjords.

Since the summer of 2016, Vision of The Fjords has ferried passengers from the tourist hub of Flåm and into the spectacularly narrow Nærøfjord.

“We wanted to take the lead and show what is possible”, says CEO Rolf A. Sandvik in The Fjords DA, who commissioned the Brødrene Aa yard to build the innovative vessel in 2015.

Back then, battery technology did not support the vessel size, and the developers chose hybrid technology. When the catamaran reaches Nærøfjord, it switches to electric power, and sails silently and emis-

sion-free into the World Heritage area.

“When building a boat that will carry passengers into a vulnerable area for the next decades, there is no alternative but to commission something environmentally friendly. If Norway is to live up to its tourism motto: ‘Powered by nature’, the local transport system in our World Heritage fjords must become 100 % zero-emission,” says Sandvik, The Fjords DA currently operates eight sightseeing vessels in Nærøy and Geiranger. Battery technology is constantly improving, and the next vessel they commission will hopefully be 100 % emission-free.

Vision of The Fjords cost approximately 100 million NOK to develop. In addition comes charging infrastructure on shore, also developed and financed by The Fjords DA. Still, the owners are convinced it will pay off. However, Sandvik finds it hard to accept that neither local nor national authorities offered any financial or regulatory incentives to even the playing field and speed up the necessary change.

“Few have the financial muscles to do what we did,” he says, adding that serious actors in the Cruise industry have embraced the Vision of The Fjords in their land programmes, proving that zero-emission



► gives an edge in a competitive market.

“Several cruise lines now have an impressive list of environmental procurement demands,” he adds.

**ABOUT TO CHANGE** › To explain the lethargic response to the challenges by national and local authorities, Shipping adviser Jan Kjetil Paulsen in Bellona points to the fact that there are six municipalities, three County Councils, three County Governors, two World Heritage Councils and a host of government bodies involved in the development and governance of the UNESCO protected fjords. In addition there is an element of competition between the fjord communities.

A fact that the Mayor of Norddal knows all too well. To realize his vision, he must convince sceptics in neighbouring municipalities, who fear a green harbour at Vallidal will steal traffic from other sites.

“But there is plenty to go around,” Sandnes ensures. The conservative estimates from the marketing organisation Fjord Norway is a 60 % increase the total number tourists in the area by 2030.

“We must come together and coordinate the cruise traffic and solutions across municipal boundaries,” says Sandnes.

The new Sustrans project could prove a step in the right direction: a three-year research initiative, lead by the Norwegian University of Science and Technology (NTNU), aimed at assisting decision makers in developing sustainable transportation systems in rural tourism pressure areas. The researchers will use the Geirangerfjord area as a case study, and look at sea and land transportation in the Municipalities of Stranda and Norddal combined.

“I also plan to take the matter to the World Heritage Council for Geiranger, where I am a member. I believe the Council has the necessary legitimacy to push for change, if its members are convinced the World Heritage area is in danger,” says Sandnes.

Bjørn Pedersen of the Norwegian Maritime Authority adds:

“Now we need to shift focus from problems to solutions, and the potential for business growth presented by zero-emission development in World Heritage fjords.»

## Electric Arctic adventures

The schooner “Opal” might look old, but it is fitted with state of the art electric propulsion technology.

Silently, “Opal” brings tourists whale watching, northern lights spotting and skiing in remote Arctic landscapes.

“Opal”, owned by North Sailing, is the world’s first plug-in hybrid regenerating sail ship. The silent technology allows for closer and less disturbing encounters with the marine giants. Combined with substantial emission cuts, “Opal” takes a big step towards more sustainable operation in the fragile Arctic.

The unique electric propulsion system was developed in cooperation with Bellona and several other partners in the innovative Rensea project. The ship charges with shore power during the night, which provides enough power to run day-tours on batteries only.

“Tourists in general are increasingly aware of the climate and environmental footprint they leave behind, and thus we are convinced that the demand for environmentally friendly alternatives will continue to increase”, says Agnes Árnadóttir, who runs the Norwegian branch of the family owned Icelandic company.

The new and improved “Opal” first set sails in July 2015. Since, North Sailing has installed the hybrid-electric propulsion system in a second boat. Their aim is to make their entire fleet zero-emission.



**EXCESS POWER:** Inge Bjørndal (right), Director of Economic Development in the Municipality of Stranda, and the Manager of the Ringdal Power Plant hope to utilize excess power to produce hydrogen to fuel local transport.

PHOTO: NILS HARALD ÅNSTAD/SUNNMØRSPOSTEN

### THE HELLESYLT HYDROGEN HUB:

## Aim for local hydrogen production

A small village in the World Heritage Geirangerfjord area has a grand vision: To convert surplus hydropower into hydrogen that can power local transport.

TEXT: MARIANNE ALFSEN/  
FELIX MEDIA

In heavy rainfall, the three small-scale hydroelectric power plants in the rivers around the village of Hellesylt must let water bypass the turbines, and watch thousands of potential KWh of electricity go to waste – as the local grid is not dimensioned to cope with the excess power.

Now, the Municipality of Stranda, where Hellesylt is situated,

wants to produce hydrogen to exploit the full power potential. The Hellesylt Hydrogen Hub project was set in motion in 2016, in cooperation with a range of public and private partners, including Bellona.

“This is a creative project, that shows how small scale innovation can have big local impact,” says Jan Kjetil Paulsen, senior shipping adviser in Bellona.

The project includes the entire value chain, from production to infrastructure and customer base – which comprises both land and water based transportation of passengers and goods.

Hydrogen busses, cars and lorries are already in the market, but the local sightseeing boats and ferries represent the main potential customer base, as Hellesylt is a gateway to the World Heritage site of Geirangerfjord. Thus The

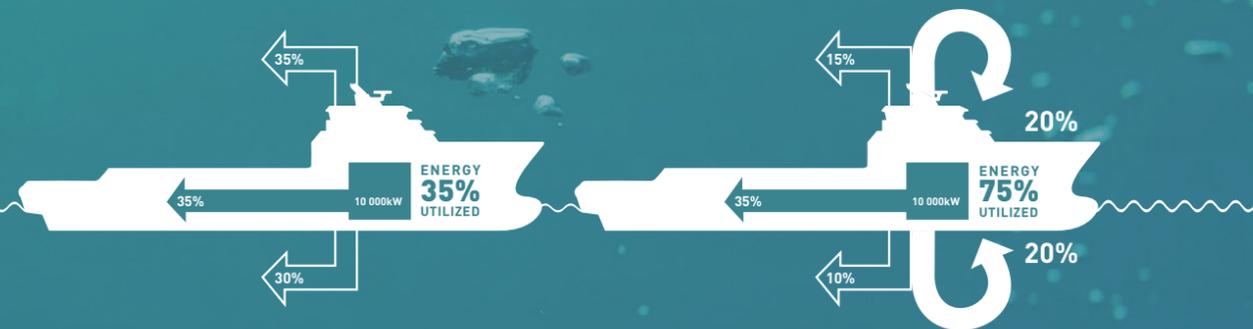
Hellesylt Hydrogen Hub could not only curb the waste of clean power, but also contribute to preserving pristine and vulnerable nature.

“One local operator, Geiranger Fjordservice, has commissioned a new tourist boat, which will be equipped to convert to hydrogen when it becomes available,” says Inge Bjørndal, Director of Economic Development in the Municipality of Stranda. He is also lobbying Fiskerstrand Yard in Ålesund, who are developing the world’s first hydrogen ferry, to test it in Hellesylt when it is ready in 2020.

“We have developed plans for a technically feasible project. What remains is financing,” says Bjørndal, adding that they are working on private financing models, but will also need public funding.

# MOBILIZING WASTE ENERGY

Expanding the utilities for energy utilization



The world is facing huge challenges related to emissions from fossil fuel. The cost of energy is high, especially in terms of negative environmental impact. More than ever green technology is needed.

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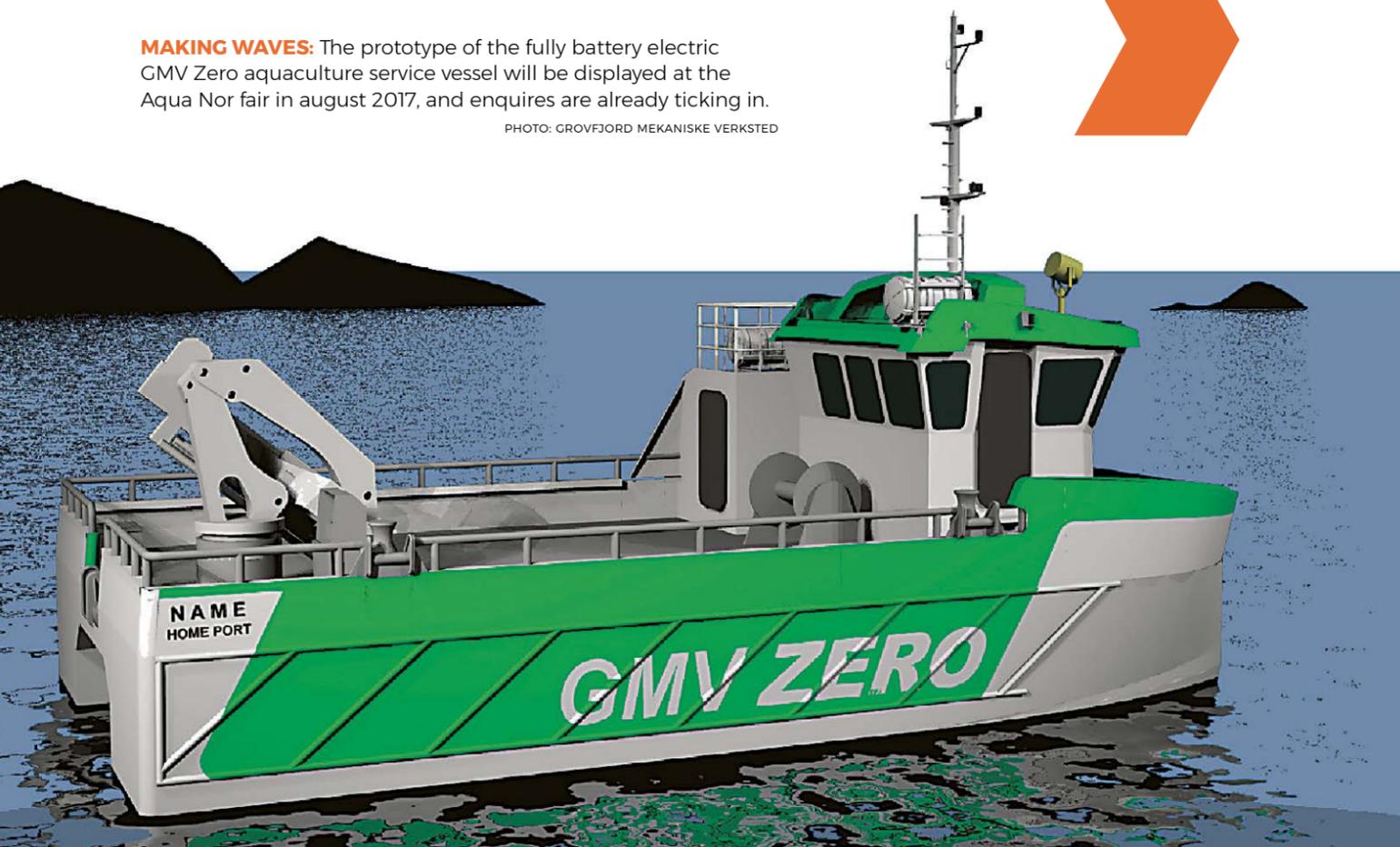
# Aquaculture goes electric

This summer, the world's first fully electric fish farm service vessel will be launched in Norway. The vessel is the brainchild of 81-year-old Arnold K. Hansen.

TEXT: MARIANNE ALFSEN/FELIX MEDIA

**MAKING WAVES:** The prototype of the fully battery electric GMV Zero aquaculture service vessel will be displayed at the Aqua Nor fair in August 2017, and enquires are already ticking in.

PHOTO: GROVFJORD MEKANISKE VERKSTED



**IF ALL THE APPROXIMATELY** 450 fish farm locations in Norway replace one of their diesel powered service vessels with an electric vessel, emissions from the aquaculture industry will be cut by 43,000 tonnes CO<sub>2</sub> annually – the equivalent of more than 16,000 cars – and 436 tonnes of NO<sub>x</sub>.

“But it was actually concern for people’s health that spurred the idea, the fear that breathing in the diesel fumes could cause cancer,” says Arnold K. Hansen.

In 2003, Hansen and his son took over the family business, Grovfjord mekaniske verksted, a few miles into the fjords from the Northern Norwegian town of Harstad. Since 1919, the company had specialized in boat repairs. Father and son developed Grovfjord into a shipyard, specializing in building light aluminium vessels for the ever-growing aquaculture industry.

**FROM UTOPIA TO REALITY** › When the planning started in 2012, a fully electric zero-emission service vessel was still utopia. Battery technology was nowhere near the necessary capacity or size. The first ideas thus revolved around hybrid technology. In the wake of the electric car revolution in Norway, battery technology evolved faster than anyone had envisaged.

“Thus we could go for a 100 % battery electric and zero-emission solution,” says Hansen, who has collaborated with local scientists to develop the vessel.

But there were additional stumbling blocks: innovation was moving faster than the regulatory authorities. There was no regulatory framework for the certification of vessels up to 15 metres. Arnold K.

Hansen did not have time to wait for the authorities to come around. He asked the classification company DNV GL to suggest a regulatory framework to the Norwegian Maritime Authority, who embraced the initiative.

“We pushed forward a regulatory framework that will benefit many,” says Hansen.

**A GROWING MARKET** › Fish farms scatter the entire Norwegian coast. Some are close to populated parts of the coast, while others are situated in remote areas. Thus a flexible design was necessary.

“We hope to develop a standard vessel, but each vessel will probably have to be adapted to specific needs,” explains Hansen.

The so-called GMV Zero service vessel can be charged at its base and by the feeding barges on site, which in most places have shore power.

“With a rapid charger, it can be charged over lunch,” says Hansen.

Eventually, Grovfjord plans to deliver service vessels with six different battery capacities.

“We plan to build 12 vessels annually,” says Hansen, who does not expect to be alone in the electric service vessel market for long.

“Zero-emission is no doubt the future,” he adds.

The world’s first plug-in hybrid service vessel – “Elfrida”, built by another Norwegian yard: Ørnli Slipp – was launched in February this year, and is already hard at work for Salmar Farming.

Estimates suggest that the Norwegian aquaculture could increase fivefold by 2050. Hence, the potential market for innovative service vessels such as the GMV Zero is set to shoot through the roof.

PHOTO: GUNNAR LUND/KUPA



“ I look forward to going to work every day. This is an enormously exiting project

**ARNOLD K. HANSEN**  
PROJECT MANAGER, GMV



# The harbour as a renewable energy hub

The green harbours of the future can become clean energy hubs for both land and sea based transport, particularly in bigger cities. The key is shore power.

TEXT: MARIANNE ALFSEN/FELIX MEDIA ILLUSTRATION: SIEMENS

**THERE ARE** 32 main ports in Norway, handling the transportation of goods along the more than 100,000 kilometre coastline. Bellona's wet dream is that all of them, along with the 10 largest cruise harbours, will offer renewable shore power in the future.

"High infrastructure costs is a major obstacle," says senior shipping adviser Jan Kjetil Paulsen in Bellona. But he knows a way around:

"To make shore power more financially feasible, we should widen the scope and think of harbours as clean energy hubs for both land and sea transport, providing multiple sources of green energy for all types of vessels and vehicles."

## FACTS: POTENTIAL EMISSION CUTS FROM CRUISE SHIPS AND CARGO SHIPS

- › 360,000 tons of CO<sub>2</sub> (equal to 5 % of emissions from the Norwegian car fleet)
- › 679 tons of Particulate Matter (equal to 100 % of emissions from the Norwegian car fleet)
- › 37 tons of sulphur dioxide (equal to 100 % of emissions from the Norwegian car fleet)
- › 7072 tons of NO<sub>x</sub> (equal to 58 % of emissions from the Norwegian car fleet)

Source: A 2016 study of shore power made by Bellona, Siemens, Nelfo and EFO



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**NO HFO:** Hurtigruten chooses not to use heavy fuel oil in any of its ships. Four of its new expedition ships will have batteries onboard.

## Joint call to ban heavy fuel oil

As the sea ice melts, shipping activity increases in the Arctic. "It is time to say no to HFO," says the Norwegian shipping company Hurtigruten.

BY: ELLEN VISETH, BELLONA

Heavy fuel oil is banned in the North Sea, the Baltic Sea and in the coastal areas of the US and Canada. Ironically, it is still allowed in the most vulnerable area: the Arctic.

About 44 percent of ships operating in the Arctic use heavy fuel oil (HFO).

The ships emit CO<sub>2</sub>, Sulphur and soot that accumulates on Arctic ice cover and accelerates ice melt. Increased shipping activity in the Arctic also raises the risk of a major oil spill.

### Self-imposed ban

"The use of HFO has already been banned in the Antarctic, now it's time to ban it in the Arctic as well," Hurtigruten CEO Daniel Skjeldam says.

Hurtigruten is the world leader in expedition travel, with 14 ships sailing from pole to pole. They are also operating the route along the rugged Norwegian coastline.

Although they could, Hurtigruten has for years chosen not

PHOTO: HURTIGRUTEN



**TIME FOR A BAN:** "Heavy fuel oil is already banned in the Antarctic. It's time for an Arctic ban as well," says Hurtigruten CEO Daniel Skjeldam.

to use heavy fuel oil in any of its ships.

"An accident involving a mega ship and spill of heavy fuel oil in the Arctic would represent an environmental disaster. If HFO is spilled in cold Arctic waters, it will have larger consequences than anywhere else. The Arctic deserves sustainable growth and the industry needs to move first," says Skjeldam.

### Companies push for HFO ban

This January he signed The Arctic Commitment on behalf of Hurtigruten, marking the start of a Ban HFO campaign. Later, the 23 companies in the Association of Arctic Cruise Operators also pledged not

to use HFO in the Arctic.

The fact that more and more companies are swearing off HFO could become a lever of influence with the International Maritime Organization, hopes Sigurd Enge, Bellona's manager for shipping and Arctic issues.

### Hurtigruten goes hybrid

Enge urges ship owners to adopt regulations now; otherwise the shift to greener technology will take longer and be more expensive.

"Best available technologies, such as battery hybrid solutions, must be used in the Arctic. Yet, the very first step is to ban the dirtiest and cheapest fuel," adds Enge.

Hurtigruten is ready to meet the future with up to four hybrid powered expedition ships on order.

"The shipping industry must be a frontrunner in promoting regulations that will secure sustainable Arctic growth," Skjeldam says.

# Taking salmon from wheel to keel

Ports from Nordmøre to Helgeland plan to export fresh seafood by boat to their largest market: Europe. This could eliminate CO<sub>2</sub> emissions from 13,000 refrigerator trucks filled with salmon each year.

BY: TORKIL MARSDAL HANSSSEN, PKOM

**TRØNDELAC ALONE** produces 400,000 tons of salmon each year. Over the next ten years, production will double; by 2050, the volume could be five times larger. There are challenges in terms of road standards, traffic accidents and the environment,” says Paul Ingvar Dekkerhus, Director of Ports in Nord-Trøndelag.

He is also the project manager of a Coastal Alliance including the central Norwegian ports of Kristiansund, Trondheim and Helgeland. Now the Alliance is working to secure return cargo for planned shipping to Europe.

**A SEAFOOD GIANT INVESTS IN SEA TRANSPORT** › The Alliance is showing that it's possible to transport fresh seafood by sea from central Norway to Europe in times consistent with industry standards. New investments are flowing into coastal ports in western Norway to accommodate roll-on/roll-off ships, which can carry refrigerator trucks directly

to Denmark. The seafood giant Lerøy has likewise decided to invest 3 billion kroner in a new salmon packing plant from the harbor.

”More than 60 percent of the seafood produced in Trøndelag today is sent by truck to Europe. We believe that ships should transport at least half of it. In that case, we could remove 13,000 trailers a year,” says Dekkerhus.

**DEADLY TRAFFIC STATISTICS** › A report from Institute of Transport Economics (TØI) shows that more Norwegians killed in traffic accidents involving larger trucks than the European average. According to the TØI, prosperity and business growth have put more freight on the road, and with it comes more accidents.

”You don't have to be a rocket scientist to see the relationship between the accident statistics and the location of Norwegian seafood companies. The expected growth in seafood exports

can make these numbers even worse if we don't find new transport solutions – shipping by boat should

“We could remove 13,000 trailers a year.”

**PAUL INGVAR DEKKERHUS**  
DIRECTOR OF PORTS  
IN NORD-TRØNDELAC

be an obvious choice for coastal industries,” says Dekkerhus.

**EMISSIONS GO DOWN AT SEA** › Bellona's senior consultant Jan Kjetil Paulsen agrees. He has made climate calculations for transporting fish by sea from western Norway's ports to Denmark, and they were encouraging. He looked at data from TØI and the maritime classification organization DnVGL to determine how much CO<sub>2</sub> vessels steaming between central Norway and Denmark would emit and compared that to emissions figures for trucks.

”A ship will only emit 24 percent of the CO<sub>2</sub> compared to trailers hauling the same amount of fish. With LNG / hybrid ships, the emissions go down to 17 percent,” says Paulsen.

His calculations are based on two ships sailing at 14.5 knots. This is slower than the 19 knots that the Coastal Alliance believes is necessary to maintain for the start-up phase, which will include only one ship.

**FISH-FARMERS HAVE THE KEY** › Bellona's Paulsen is clear that sending fish to market by ship will reduce emissions – if fish farmers get on board:



**OBVIOUS:** Shipping fish by boat should be an obvious choice for coastal industries, says Paul Ingvar Dekkerhus of the Coastal Alliance. PHOTO: PKOM

”In practice, fish farmers are key to make this happen. Trailer transport is easy with good logistics. It requires both reorganization of systems and routines to achieve the goal of shipping salmon by sea. With the production volumes we have in central Norway today, it is both desirable and possible to achieve this goal. The fish farmers must be aware of their responsibility. This is a triple win that saves money, the environment and lives,” says Paulsen.

# Join us

## From Pollution to Solution

### Our Vision:

By 2050 international shipping will be sustainable and carbon-neutral. Other emissions and effluents must be eliminated or be within the nature's ability to assimilate.

Bellona works with the industry to develop technology, value chains and business models for a sustainable future.

The Bellona Foundation is an independent non-profit organization that aims to meet and fight the climate challenges, through identifying and implementing sustainable environmental solutions.

**BELLONA**

www.bellona.no

# BELLONA'S MARITIME CODE FOR SHIPOWNERS

1. Use batteries and zero emission solutions when You can - and bio fuel when You must

2. Show respect to our fjords: Nature and tourists don't like smog

3. Polar Bears hate soot and sulphur:  
No heavy fuel oil in the Arctic

4. No diesel when docked:  
Install a shore power plug now

5. Ships must be sustainably recycled:  
Off the beach

6. Avoid stowaways:  
Never dump ballast water

7. Get the freight off the roads -  
Say yes to rails and sails!

8. Save fuel - save money:  
Think energy saving

9. The ocean is our common pantry:  
Choose the paint on your hull carefully

10. Plan your passage, arrive at the right time.  
Slow down if needed.



Eidesviks Viking Princess blir det første fartøyet i sitt slag hvor batterier faktisk reduserer antall generatorer om bord. Slik tar de batterirevolusjonen til sjøs ett steg videre. – Dette skal ikke gå på bekostning av verken bruk, kvalitet eller sikkerhet. Hvis dette fungerer slik vi forventer, vil dette ha en positiv signaleffekt i bransjen, sier adm.dir. Jan Fredrik Meling i Eidesvik.

# Eidesvik fikk 6 millioner – nå bytter de diesel med batteri

**Vil du også redusere energibruken i dine skip? Vi kan hjelpe deg frem til målet om å kutte både driftskostnader og klimagassutslipp.**

Enova kan bidra til å øke konkurransekraften for rederier ved å ta i bruk ny energi- og klimateknologi. En rekke bedrifter i næringen reduserer nå sine klimagassutslipp med støtte fra Enova. Du kan også bli en av disse.

Les mer om mulighetene for dine skip på [enova.no](https://enova.no), eller ring oss på telefon 952 98 000.

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