CANDELA BOREAL

White paper.

This white paper explores how Norwegian operator Boreal sees its recently acquired fleet of Candela P-12s opening up new possibilities in commuting, urban development and tourism.

Executive Summary

Norwegian cities have an urgent need for mobility solutions. Roads are full, the queue of infrastructure projects is long, and financing is uncertain. The losers are not only the climate, but projects for new housing, the attractiveness of cities and, in the end, the citizens who spend hours in traffic every day. The question is creating strong debate: the waterways are already there - how can we use them even more?

Boreal believes electric hydrofoil vessels offer a solution. The public transport operator ordered 20 Candela P-12s, which use hydrofoils to reduce energy consumption by up to 80 percent and also reduce charging and infrastructure requirements.

For Boreal, however, the bigger opportunity is not simply replacing existing ferries. Smaller, efficient vessels could make new direct routes viable, connecting communities, city centres and transport hubs.

This white paper explores what Norway's experience can teach other markets, why Boreal is investing in electric hydrofoils, and how the technology could open new possibilities for commuting, urban development and tourism.

"You can create spectacular travel experiences with these vessels, while also future-proofing the business for future regulations."

Nikolai Knudsmoen Utheim
CEO Boreal

Norway’s core challenge:

Norway has a mobility challenge. Population growth keeps concentrating in and around its cities, but road and rail capacity has not kept pace. For city planners this is more than a comfort issue: congestion constrains where new housing can be built, slows the connections between suburbs and city centers, and limits how quickly new urban hubs can grow to meet demand.

This has become a wicked problem for Norway. The country manages one of the world’s largest sovereign wealth funds, yet a fiscal rule limits how much of that wealth can flow into the domestic economy each year. Major road, rail and tunnel projects also move through a twelve-year National Transport Plan (Nasjonal Transportplan) before construction starts, and industry voices regularly point out that announced projects are postponed or replanned rather than built. Wealth, in other words, has not translated into speed.

Meanwhile, the appetite for more water-based transport keeps growing from three parties at once. City administrations and private developers building new neighbourhoods along waterfronts increasingly treat a ferry connection as a precondition for the realisation of their projects, since roads alone cannot absorb the added traffic from thousands of new homes. Residents are voicing the same need directly: organising themselves in vocal groups demanding more waterborne mobility from their politicians.

Lessons learned: Norway's electrification of water transport

Norway's green ambitions has led to electrification of transport, on land and water. Since the battery-electric 'Ampere' entered service in 2015, Norway has deployed 111 electric car and passenger ferries, more than any country. On the national road ferry network alone, direct annual CO_2 emissions fell from 300,000 tonnes in 2015 to a projected 149,000 tonnes in 2025.

But achieving those reductions with conventional vessels has required significant investment. Norwegian ferry electrification has also required substantial upgrades to grid and charging infrastructure.

The 'Bastø Electric', operating Norway's busiest ferry crossing between Moss and Horten, carries a 4.3 MWh battery and charges at up to 9 MW - comparable to the instantaneous electricity demand of a small town.

The challenge has been even greater for hurtigbåter, Norway's high-speed passenger vessels serving communities along its long coastline. Speed dramatically increases energy consumption, while their schedules often leave little time for charging. Norway has therefore electrified far fewer high-speed passenger routes than conventional ferry routes.

In Oslo, two high-speed passenger vessels, 'Baronen' and 'Baronessen', have been converted for battery-electric operation using swappable battery packs. The swapping system is designed to exchange batteries within minutes while the vessels are at berth, allowing the batteries to charge more gradually onshore. The project experienced delays, but the world's first operational battery-swapping system for express boats entered operation at Nesodden in May 2026. In the first phase, the vessels operate in hybrid mode, combining battery-electric operation with HVO fuel, with the share of electric operation expected to increase over time.

Why Boreal invested in the Candela P-12

Against this backdrop, in April 2026, Boreal ordered 20 Candela P-12 electric hydrofoil vessels - the largest fleet of its kind ordered to date, set to enter service in 2027. Boreal is one of Norway's largest public transport operators, with around 3,000 employees and operations spanning buses, trams, high-speed passenger services and ferries across the country. It is also an experienced operator of electric ferries, giving it first-hand experience of both the opportunities and challenges of maritime electrification.

While Norway has successfully electrified many conventional ferry routes, high-speed passenger vessels have proved considerably harder to electrify. The Candela P-12 offers a different approach.

Key features of the Candela P-12

80%

Lower energy usage

Up to 80% lower energy consumption than conventional vessel of the same size.

Minimal wake

The Candela P-12 generates minimal wake when foiling, reducing disturbance to shorelines and surrounding waterways.

Reduced noise & superior comfort

C-POD motors reduce underwater noise while providing a smooth, quiet ride in a spacious cabin.

25 kn - 40 nm

Speed & range

With a 25-knot service speed and up to 40 nautical miles of range, the Candela P-12 serve high-speed routes.

Electric hydrofoil vessels: how the Candela P-12 can open new routes

Instead of compensating for high energy consumption with larger batteries and more powerful chargers, the Candela P-12 reduces the energy requirement itself. Computer-controlled hydrofoils lift the hull above the water, reducing energy use by around 80 percent. The 30-passenger vessel travels at 25 knots and has a range of around 40 nautical miles. When foiling, it produces minimal wake and noise.

The efficient Candela P-12 can use standard DC fast-charging technology for electric cars, rather than bespoke multi-megawatt chargers. The same charging stations can also serve cars, and privately owned boats. Retractable foils and the adjustable bow ramp make it compatible with existing ports and docks. Already serial-produced, Candela P-12 can also be deployed without the long lead times associated with one-off vessel builds.

The Candela P-12 Shuttle supports 300 kW DC fast charging, reaching 10–85% charge in approximately 45 minutes. Its high energy efficiency also reduces the need for large-scale charging infrastructure.

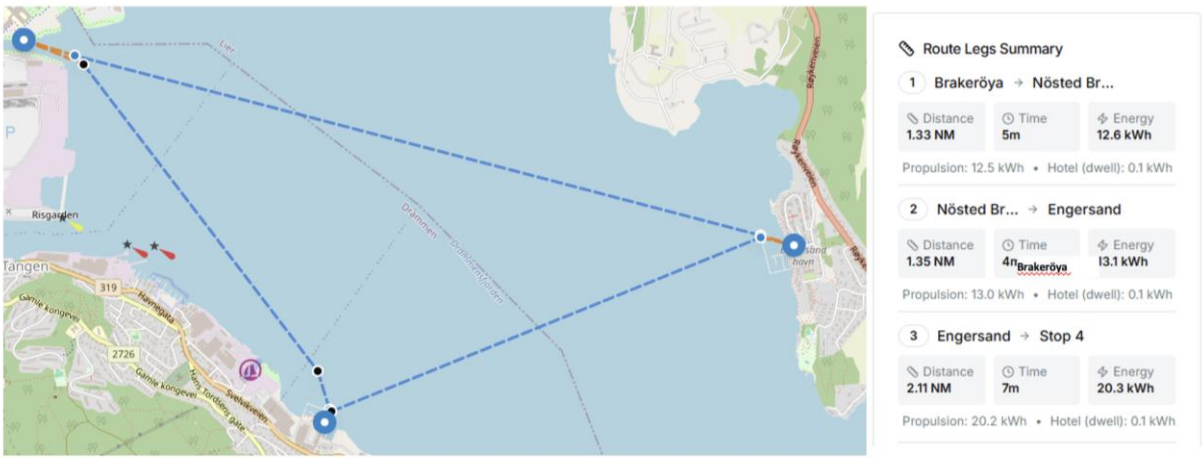
Drammen pilot: attracting car commuters to public transport

Boreal's first four Candela P-12s are scheduled for delivery in 2027, with the remaining vessels following between 2028 and 2030. In Autumn 2025, the Candela P-12 was tested in Drammen as part of a pilot examining the potential for waterborne public transport in the region. The project involved Eirill Eckbo from DRMA Architecture and Urbanism, then leading the private-public initiative Green Growth Drammen, a first mover for introducing Candela P-12 to Norway.

“The most important first lesson was how little infrastructure is actually needed. We could use existing piers and temporary charging, which means you can test routes much more quickly and scale them once you know where the demand is.”

The pilot examined how electric passenger services could support commuting and urban development. Around 900 people took part, while TØI’s subsequent study was based on responses from 763 test users. Around two-thirds reported a high likelihood of using a permanent service, particularly for trips into the city center.

Engersand – Nøstad – Brakerøya: Route overview



For Boreal, also, the bigger opportunity is not simply replacing existing ferries. Eirill Eckbo argues that transport planners often start with the wrong question:

> “What can a new vessel do on an existing route? The more interesting question is: Which routes have never been possible because the right vessel did not exist?”

Interview with TØI institute: electric hydrofoils can reshape public transport

Christin W. Krohn from TØI, Norway's Institute of Transport Economics, led the pilot of the Candela P-12 in Drammen. The findings challenge some conventional assumptions in transport economics.

The Candela P-12 was tested on a series of routes linking central Drammen with the new hospital at Brakerøya and communities further down Drammensfjorden, including Engersand and Svelvik. The Candela P-12 could save time as the water provided a more direct route: Engersand–Drammen took around 14 minutes by Candela P-12 versus 30 minutes by bus, while Engersand to the hospital Brakerøya took around 5 minutes versus 16 minutes by bus.

TØI found the highest expected use among people who currently travel by car, proving that fast waterborne links can shift commuters away from the road.

But the pilot also raised a bigger question: what if expanding public transport does not require building more roads, rail or heavy infrastructure?

"The basic challenge with land-based transport is that infrastructure is extremely expensive. Rail is insanely expensive. You need signaling systems, to build tracks and a huge amount of supporting infrastructure, and the trains themselves cost enormous sums. The same applies to building roads". W. Krohn says.

Cost to build 1 Km of infrastructure in Norway:

Road

€10-70 m

Rail

€60-100 m

Water

€0 m

Waterways: free infrastructure

Maintenance associated with land-based infrastructure such as roads and railroads, she argues, is also politically difficult.

“Politicians like building new things, because then you can cut a ribbon. Maintenance is much less visible, even though it is absolutely essential.”

Waterways, however, are free and already exist - but using them with conventional vessels still remains costly. The conventional wisdom has been that, to make economic sense, ferries need to be large enough to spread their operating costs across many passenger seats.

“Then you need larger quays and terminals, more crew and more energy. Everything becomes bigger and more expensive.”

What makes the new generation of small electric hydrofoil ferries interesting, W.Krohn says, is that they reverse much of that logic.

“What is very different with this technology is that you have small, serially produced vessels that in themselves are quite inexpensive, and that can call at many different places. You do not need huge terminal infrastructure.”

Charging is another important difference between the P-12 and conventional, larger vessels.

“I have seen charging infrastructure for electric passenger vessels costing around NOK 30 million, and then that installation can essentially only serve that particular vessel. With the Candela P-12, you use conventional EV charging, and the charger can potentially also be used to charge cars” says W. Krohn.

A new model: smaller vessels provide flexibility

The reduced cost of infrastructure not only makes it inexpensive to introduce a service but also changes how the vessels themselves can be used.

“During rush hour, you can use them for commuting. In the middle of the day, they can serve tourism or other demand. In the evening, they can be moved somewhere else. That is completely different from a train or bus that is tied to fixed infrastructure.”

W. Krohn says this flexibility has challenged some of the assumptions researchers normally make about ferry transport.

“The researchers were almost mind-blown by it, because we are so used to thinking that ferries operate on fixed routes. With these vessels, you suddenly must sit down and rethink the whole system.”

For Krohn, this open new ways of how waterborne transport can be conducted, and new ways for city planners to think.

“This is really a different and new form of transport. The infrastructure requirement is very small, and the capacity can be used much more flexibly. Once you have vessels like these, it becomes possible to think about the transport system in a completely new way.”

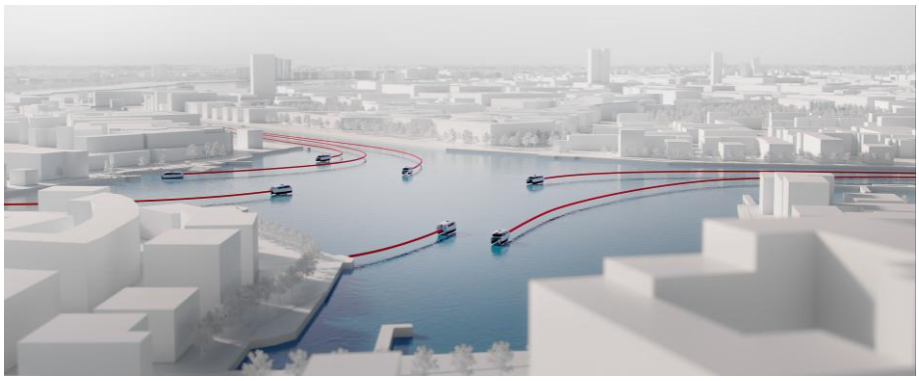
Urban development: enabling new direct routes

One of the traditional hurdles to waterborne transport has been high operating costs. That challenge is particularly relevant in Drammen. New neighbourhoods are being developed along the river and waterfront, while expanding road and rail capacity is difficult. The waterway already exists. What had been missing was a solution that could use it economically without requiring major new infrastructure.

“Small (diesel) vessels have existed before, but they are expensive to operate. With the Candela P-12, the business case for direct lines where passenger demand is too low for big vessels suddenly becomes viable”, says Eckbo.

“A 200-passenger ferry may still be the right solution when 200 people need to travel at once. But during the rest of the day, smaller vessels can maintain frequency on routes where a large ferry would be difficult to justify. It is also possible to shift capacity to other routes, which is impossible with just one large ferry”, says Eckbo.

For urban developers and communities, low energy use can make new direct routes more viable. Norway has many cities and communities built around fjords, rivers and lakes, with housing and workplaces often concentrated along the waterfront. Smaller, high-speed Candela P-12s could connect these places directly - across fjords as well as into city centers - making waterways part of the wider public transport network rather than simply corridors for traditional ferry services.



Use cases: connecting new hubs with the Candela P-12

While Boreal has yet to announce where the Candela P-12s will operate, Eckbo, who now leads Boreal development of the new urban markets, says some routes are obvious candidates. One is the Oslofjord corridor between the capital's suburbs and the city center, for instance around Slemmestad, which is being developed as a new urban hub, where further growth depends on ferry capacity.

Another opportunity is crossing the Oslofjord rather than travelling along it. Eckbo points to Tofte and Moss: around 20 minutes apart by boat, but up to two hours by road. By using smaller craft, it is possible to connect communities and transport hubs directly across the fjord, rather than routing people through Oslo.

"I think we can achieve much better mobility across the fjords: a network of boat capacity dynamically adaptive to the societal needs strengthening the regions beyond bringing people to one city center " says Eckbo.

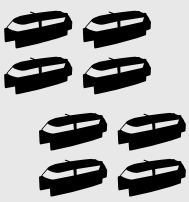
Large, infrequent & slow
-> Small, frequent & fast

Large vessel

1 large ferry
2 hour wait

Candela way

8 small ferries
15-minute wait



Recommendations from a leading Norwegian operator

Boreal's CEO, Nikolai Knudsmoen Utheim, sees opportunities in commuter transport, coastal services and tourism, where quiet, zero-emission travel is increasingly attractive.

"You can create spectacular travel experiences with these vessels, while also future-proofing the business for future regulations," he says.

Boreal's confidence in the Candela P-12 came partly from its daily operation in Stockholm.

"Ultimately, that is the most important thing: it has to work. It has to be a reliable transport solution that people can trust," says Utheim.

His message to other operators is this:

As zero-emission requirements spread, the opportunity is not just to replace diesel vessels, but to rethink what services are possible.

"We believe there is a real need for this and that the technology has the potential to create new business opportunities" he says. "And if it works the way we think it can, this will become a very exciting new market."

About the authors

This white paper has been developed by Candela Technology AB and Boreal Norge AS.

Disclaimer: This white paper is intended to stimulate discussion and explore the potential of electric hydrofoil technology in different markets, drawing on lessons from Norway.

The information in this document is provided for informational purposes only and does not constitute a legally binding offer or product specification. While every effort has been made to ensure accuracy, completeness and relevance, Candela Technology AB and Boreal Norge AS does not accept responsibility for information provided by third parties or for decisions made based on this content. The information may be updated or changed without notice. Readers should contact Candela or Boreal directly for the most current and complete information before making significant decisions.

Contact us to learn more

Eirill Eckbo
Lead Market Boreal/Candela in Norway
Director Strategy & Business Development,
DRMA Architecture & Urbanism
eirill@drma.no

Christin W. Krohn
Norwegian Center for Transport Research, TØI
Economist
crk@toi.no

Alexander Sifvert
Sales Director
Candela Technology AB
alexander.Sifvert@candela.com

Nikolai Knudsmoen Utheim
CEO
Boreal
nikolai.utheim@boreal.no

References and links

https://candela.com/

https://boreal.no/

https://ruter.no/rapporter/aarsrapport2025/baerekraft-2025/e1-klimaendringer

https://www.mynewsdesk.com/no/ruter/pressreleases/hurtigbaatene-blir-oppgradert-og-mer-miljoevennlige-3347237

https://www.miljodirektoratet.no/utskrift-nettpublikasjon/

https://www.tu.no/artikler/mister-du-konsesjonen-etter-10-ar-har-du-sponset-neste-fergeoperator-og-den-etter-der/276078

https://www.toi.no/publications/passenger-ferry-in-drammen-potential-and-user-perspectives-article39637-29.html

https://businessnorway.com/articles/norway-showcases-award-winning-electric-ferry-technology

https://www.norled.no/en/nyhet/the-worlds-first-battery-swapping-robot-commences-operation-in-nesodden-an-important-step-to-reduce-emissions-in-express-boat-traffic/