

Hydrogen vessels – status so far

Westcon Power & Automation AS

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Could hydrogen power solve the problem of shipping pollution in built-up areas?

25th March 2019

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Globally the shipping industry is a major contributor to the production of greenhouse gases. This goes largely unnoticed when ships are on the high seas, but where shipping and civilisation come into close contact, such as in major port cities and on navigated rivers, governments and residents are increasingly concerned by the levels of air pollution that shipping causes.

IMO Symposium: Ammonia and Hydrogen Are Fuels of the Future



Image Courtesy: IMO

Ammonia and hydrogen are promising potential fuels of the future in a decarbonized shipping industry, it was concluded at last week's International Maritime Organization (IMO) symposium on sulphur 2020 and alternative fuels.

In order to meet the targets set out in [the initial IMO strategy on reduction of GHG emissions from ships](#), the shipping industry needs to transition to alternative, zero-carbon fuels.

IMO's Edmund Hughes said the initial GHG strategy, adopted in 2018, had sent a clear signal to the shipping sector that shipping will need to adapt.

"We have to change to address global climate change. We have to find new technologies and new fuels if we are to achieve at least 50% reduction in annual GHG emissions from international shipping by 2050," he explained.

Maritime H2 concepts and projects



Liquefied Hydrogen Bunker Vessel Designed



GOLDEN GATE
ZERO
ELECTRIC MARINE
WATER-GO-ROUND PROJECT

September 23, 2019 | Environment, News, Tugs & Barges, Video, Video

VIDEO: Port of Antwerp orders hydrogen-fueled tug

Written by Rick Flinkey



Hydrotug will be world's first hydrogen dual fuel tug

BY THE MARITIME EXECUTIVE 2019-01-29 19:10:07

Moss Maritime, Equinor, Wilhelmsen and DNV GL have developed a design for a liquefied hydrogen bunker vessel.

Samskip utvikler hydrogendrevet containerskip

Vil seile utslippsfritt inn og ut av Oslofjorden.



EKSTRA

Havila med hydrogenkontrakt

Havila har signert avtale med leverandør av hydrogentank og brenselceller til Kyrstruten.



FRAMTIDA: Slik kan den hydrogendrivne arbeidsbåten til Osland havbruk sjå ut om nokre år.
FOTO: GREENSTAT

Hun er bare 11 meter lang og 4 meter bred, men snart kan elektriske Karoline bli en hydrogensjark



Spesial Karoline er verdens første av sin størrelse. Her er de kan den bli verdens første med brenselcelle og hydrogentank. (Illustrasjon)

UTSLIPPSFRIE HURTIGBÅTER

Utslippsfrie hurtigbåter: Hylleware satt sammen på ny måte

Det er snakk om bare to-tre år før utslippsfrie hurtigbåter for korte og lange strekninger kan leveres. Utfordringen er hydrogen- og ladeinfrastruktur.



Kystekspresen Trondheim - Kristiansund kan bli nullutslippsbåt med hydrogen og brenselcelle. (Foto: Ekte Systemer Vindst)

UTSLIPPSFRIE HURTIGBÅTER

Sogn og Fjordane vil kreve nullutslipp på åtte hurtigbåter: – Starten på en ny revolusjon



Fem konsortier står bak disse fem konseptene for utslippsfrie hurtigbåter. Sogn og Fjordane følger opp med nullutslippskrav i nye anbud. (Montasje: TU)

Klarsignal for hydrogendrevne hurtigbåter i Trøndelag

Det er fullt mulig å basere hurtigbåtsambandet mellom Trondheim og Brekstad/Kristiansund på nullutslipps-drivstoffet hydrogen, konkluderer forsk SINTEF- og Greensight-rapport. Hurtigbåten som transportmiddel har bidratt til i å bringe lokalsamfunn i Trøndelag nærmere hverandre. Men i dagens form er disse fartøyene regionens desidert største kilde til utslipp av klimagasser, målt per passasjerkilometer.



Fart
34 knop



Passasjerer
277



Motoreffekt
2600 kW



H2 Forbruk
tur/retur
180 kg



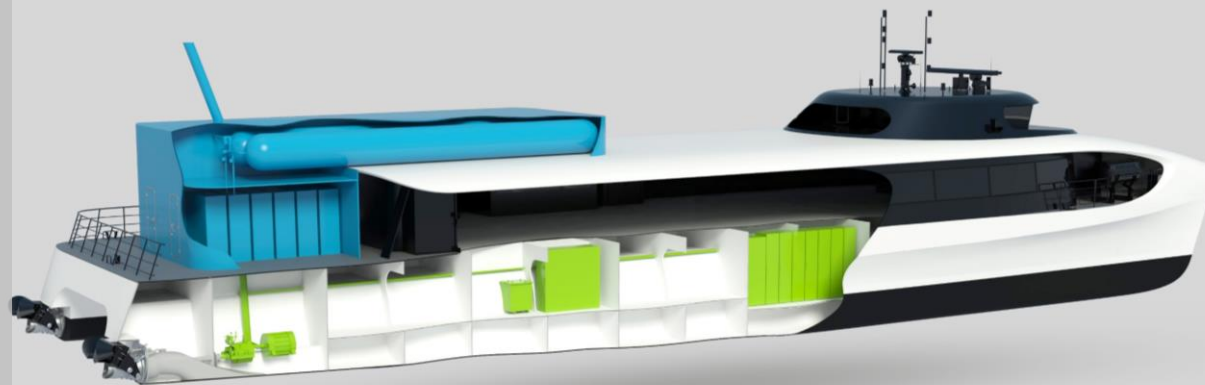
H2 Tank kapasitet
612 kg

Fuel-celler

- 12 stk x 200kW

Hydrogen trykktanker

- 250 bar
- 4 stk



Motor

- 2x 1300kW EI

EI-tavler

.

Batteri

Kapasitet 600kWh
«peak-shaving»





- This is technology development in the world class. The world looks to Norway. Hydrogen will be the last piece to get zero emissions in the ferry sector. Hydrogen is the solution where electric operation alone is not possible, says Director Terje Moe Gustavsen in the Norwegian Public Roads Administration.

Zero emissions in the ferry sector result in an emission reduction of 600,000 tonnes of CO2 each year.



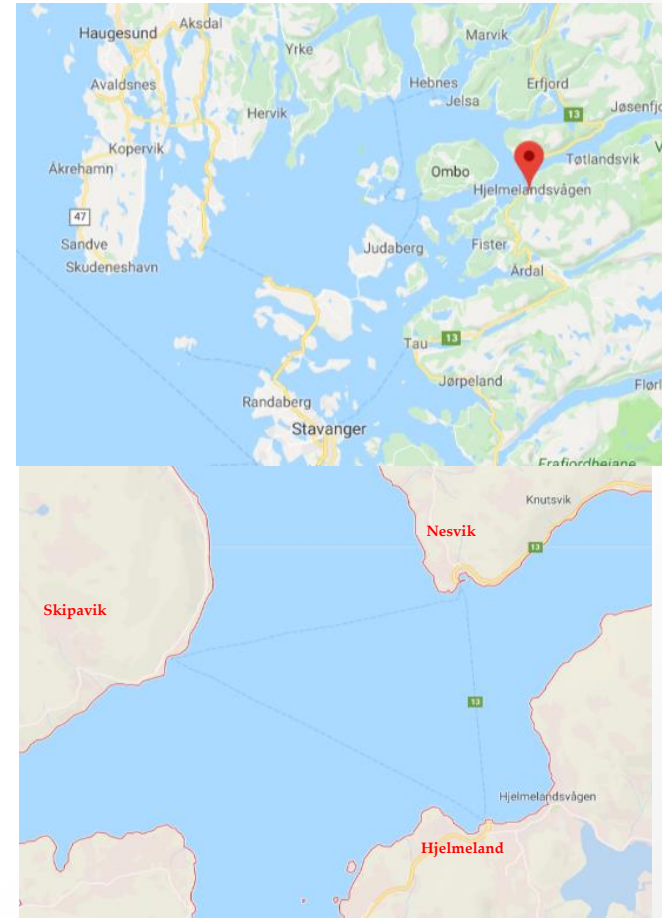
Length: 82,40m
Beam: 16,75m
Draught: 2,8m
Car cap.: 80
Truck cap.: 10
Passengers: 299

Hjelmeland-Nesvik ferry route

Ryfylke in Rogaland - Riksveg 13:

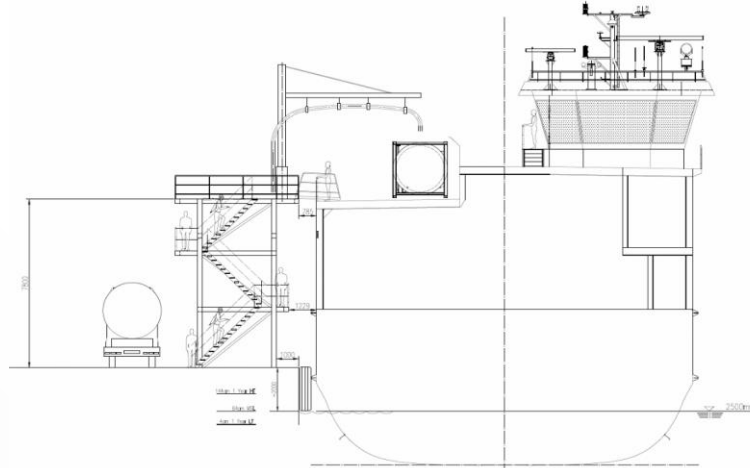
Hjelmeland-Nesvik	3010 meters
Hjelmeland-Skipavik	4450 meters
Nesvik-Skipavik	3890 meters

Norled operates the route today with two diesel-electric ferries. The new contract for this route is one battery-electric ferry, as well as the hydrogen-electric ferry, from 2021 to 2031.



Hydrogen supply

- LH2 truck from Europe
- 3,5 tons capacity
- Every three week bunkering operations
- 150 kg daily consumption



The LH₂ vessel is being built at **Westcon Yard**
in Ølensvåg Norway, delivery 1Q 2021



Vestfjorden kan bli Norges andre ferjestrekning på hydrogen: – Kan bli dyrt, men strategisk viktig for Norge

Vestfjorden kan fra 2023 trafikkeres med hydrogenferge.



Torghatten Nord trafikkerer Bodo-Værøy-Røst-Moksnes med to LNG-ferger, MF Landegode (bildet) og søsterfergen MF Værøy. Fra 2023 kan de bli erstattet av hydrogenferger. (Foto: Christoffer Hjeltnes Støle/Wikd Commons)

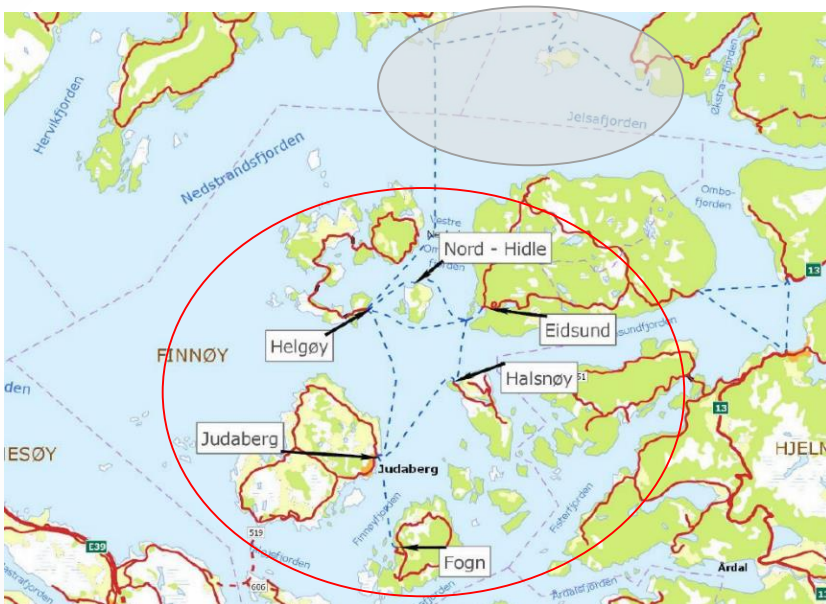




Norled and partners in FLAGSHIPS receives EU-funding:

As part of Norled's green venture, we are pleased to be part of an exciting EU project that can give us more hydrogen-powered ferries. We won the tender for Finnøysambandet and will use the support from Flagships to work towards a technical and commercially mature solution to replace biodiesel with hydrogen as fuel. <https://www.norled.no/en/news/as-part-of-norleds-green-venture-we-are-pleased-to-be-part-of-an-exciting-eu-project-that-can-give-us-more-hydrogen-powered-ferries/>

The route “Finnøy”



Distanser og tid			
Fra	Til	Distanse (km)	Tid (min)
Judaberg	Fogn	4,07	14
Judaberg	Halsnøy	5,2	15
Judaberg	Helgøy	6,5	24
Halsnøy	Eidsund	3,52	13
Eidsund	N-Hidle	3,89	14
Helgøy	N-Hidle	2,41	10
Helgøy	Eidsund	5,18	20

Norled operates the route today with two ferries and have won the new tender for this route. Two new vessels will be built for the route.

One of the ferries are planned changed from bio-diesel to hydrogen with some battery capacity to support fuel cells of 600 kW.

Hydrogen supply

- 250 bar compressed hydrogen
- Locally produced with filling from quay side at night
- Production from electrolysis
- 500 kg. pr. day



Norge får sitt tredje hybridlaboratorium

Westcon Power & Automation bygger opp et hybridlaboratorium med brenselcelle og hydrogen sammen med Sustainable Energy-katapulten på Karmøy.

Oppstart feb 2020



Westcon og Katapult åpner hybridlab. Daglig leder Willie Wågen i Sustainable Energy sammen med prosjektleder Pål G. Eide og daglig leder Gunvald Mortved i Westcon Power & Automation. (Foto: Peter Tubaaas/NCEMCT)

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Challenges to be addressed in **H2** lab projects:

- **Integration** of FC power to DC power system, control of current and voltage
- **Interface** with FC and tank emergency shut down systems
- **Life-cycle aspects**: FC lifetime strongly dependent on variable loads, integration with battery packs for peak-shaving
- **Safety aspects**: Hazard identification and Risk evaluations:
 handling of H₂ gas, control, electrical integration
- Personnell **competence development**
- Project **workflow**: interfaces with FC providers and H₂ storage providers.
- Sjøfartsdirektoratet & DNVGL : **development of rules in parallell** with design project.
- «hardware in the loop» **testing** of new automation philosophies.



VIRTUAL-FCS: VIRTUAL & physical platform for Fuel Cell System development

New project

- Topic: FCH-01-3-2019
Cyber-physical platform for hybrid Fuel Cell systems

Fuel cell specialists



System integrators/ end- users



The VIRTUAL-FCS project will develop a fully open source software- hardware (cyber-physical) tool that can be adopted as a global standard for FC system design.

Overall objective: To make the design process of hybrid fuel cell and battery systems easier, cheaper and quicker.



Thank you for your attention

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