



INNOVATION FUND

Driving clean innovative technologies towards the market

FirstBio2Shipping: First Bio-LNG production plant for marine shipping

The Innovation Fund is 100% funded by the EU Emissions Trading System



Project summary

The FirstBio2Shipping project will develop the first industrial plant converting biogas to renewable, low-carbon bio-liquefied natural gas (bio-LNG) in a standardised and scalable fashion, with minimal energy usage. The bio-LNG will be delivered to the marine industry, enabling the cost-effective substitution of heavy fuel oil (HFO). By reducing greenhouse gas (GHG) emissions by 92%, compared to conventional maritime fuel, this project brings a key innovation to support the decarbonisation of the European and global maritime sector.

COORDINATOR

Attero

LOCATION

Netherlands

SECTOR

Biofuels and bio-refineries

AMOUNT OF INNOVATION FUND GRANT

EUR 4 336 058

RELEVANT COSTS

EUR 7 226 764

STARTING DATE

01 December 2021

PLANNED DATE OF ENTRY INTO OPERATION

Q4 2023

Simplified scheme of the four main units within the project

An innovative bio-LNG production process with increased efficiency and reduced costs

The innovation of the project lies in the direct integration of a new cryogenic liquefaction technology to process biogas and convert it into bio-LNG (the iLNG technology). This increases efficiency and reduces costs. The project will aim to bring the technology beyond the current state-of-the-art in terms of performance, reliability and availability of gas treatment and liquefaction technologies. It will also validate the entire value chain from biogas to bio-LNG as a marine fuel at scale.

As shown in the figure above, all the bio-LNG plant units are integrated in a closed loop system where all gases are recovered and recycled. The demonstration plant aims to produce 6 million Nm³/year of biogas, 2 400 tons/year biomethane and 5 000 tons/year bio-CO₂. This novel integrated system resolves various challenges commonly found in the production of small-scale LNG, including: low bio-LNG quality (i.e. containing amines); high methane 'slip' (i.e. unburned methane which is released during CO₂ venting); high temperature demands in gas treatment technologies; and high costs for disposal of wastewater and toxic chemical waste.

A key technology to support the decarbonisation of the maritime sector

The produced bio-LNG will reduce GHG emissions by 92% compared to a conventional maritime fuel, representing more than 87 500 tCO₂e net absolute emissions avoided during the first ten years of operation. Ongoing R&D efforts will lead

to further reductions in methane slip over the next years, bringing even higher GHG emission reduction potential.

The project will deliver bio-LNG to the European marine industry as a 100% 'drop-in' fuel, meaning it can be used in general LNG-suited vessels without the need for additional adaptations and it can also be blended with fossil-LNG in any ratio up to 100% without any technical issues. Since maritime transport is hard to electrify (at least in the short to medium term for most vessel types), bio-LNG is an important short-term solution to decarbonise the sector.

In addition to bio-LNG, a biogenic CO₂ stream will be captured and liquefied during the project. Whilst currently being planned to be sold on the wholesale market, any future development of synthetic e-fuel production technologies is likely to find a better use of this product (e.g. synthetic kerosene, oxalic acid or e-LNG). As this would be deemed an additional use of CO₂, negative GHG emissions or net carbon removals can soon become possible.

High scale-up potential based on expected growth of the EU bio-LNG market

One of the main objectives of the project is the demonstration of the iLNG technology transferability. As the company Attero operates several organic waste digesters throughout the Netherlands, a successful novel bio-LNG production facility would be easily replicated at other regional biogas production sites.

More broadly, the scale-up potential of the iLNG technology is important. It will benefit from the expected growth of the European bio-LNG market in the next years due to a series of factors (e.g. the inclusion of CO₂ emissions from the shipping industry in the EU Emissions Trading System (EU ETS) and the availability of large quantities of biogas as subsidies/feed-in tariffs for electricity produced from biogas are due to expire in several EU countries). It also has the potential to contribute to the development of the circular economy and the bioeconomy, for example through the use of biogenic CO₂ in other sectors.