



NAUTILUS

D7.5 – Emission Analysis

Acronym: Nautilus
Project Title: Nautical Integrated Hybrid Energy System for Long-haul Cruise Ships

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Programme: Horizon 2020 Framework Programme
Topic: LC-MG-1-8-2019 Retrofit Solutions and Next Generation Propulsion for Waterborne Transport

Instrument: Research & Innovation Action (RIA)



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Deliverable D7.5 – Emission analysis

Short summary: A detailed emission analysis has been carried out with the aim to quantify air pollution emissions from the Nautilus SOFC genset demonstrator. The results are compared against traditional and state of the art marine Internal Combustion Engines (ICE). Existing SOFC and ICE emission studies were reviewed. Baseline emissions were quantified, including marine ICEs operating with HFO, low sulphur distillate fuels and LNG. An experimental method that combines FTIR and state of the art ppb range emission analysers for key pollutants (SO₂, NO_x and PM) and emerging pollutants (Black Carbon, Ultrafine Particles and Methane) was developed and first evaluated at POC stage (D3.2). The method was optimized, extended and eventually applied during a three-week intense measurement campaign at the SOFC Genset Demonstrator at DLR (in M52). The measurements included static tests, ramp rate tests, simulated hot standby conditions, and four real sailing profiles (developed in WP6).

The results show that the Genset has ultra-low NO_x emissions over the load range 60-100% (<6 mg/kWh), lower than published values for other SOFC systems. NO_x emissions were increased at lower loads. SO₂, PM and BC concentrations were near or below the analyser detection limits. Methane slip at the tested conditions was 3 orders of magnitude lower than for present ICE-LNG ships. Particle number concentrations in the chimney were below ambient levels at loads below 80%, evidence for moderate emissions of ultrafine particles was presented at the highest loads. At 80% load, the emission reduction potential of the Nautilus Genset was >99% for PM, SO₂, NO_x and BC compared to the base case of ICE-HFO and >90% compared to the ICE-LNG case. Finally, the experimental data was used to simulate emissions for typical loads of a tentative 53 MW Cruise Ship operating with only SOFC modules. A strategy developed in D3.5 is evaluated and show potential to reach ultralow NO_x emissions also at typical harbour conditions when energy demands are low.

Due date: 31/12/2024
WP, leader: [WP 7, TUD]
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Dissemination Level

PU	Public	<input type="checkbox"/>
PP	Restricted to other programme participants (including the Commission Services)	<input type="checkbox"/>
RE	Restricted to a group specified by the consortium (including the Commission Services)	<input type="checkbox"/>
CO	Confidential, only for members of the consortium (including the Commission Services)	<input checked="" type="checkbox"/>

Document history

Version	Date	Name	Chapters edited	Reason for change
V0.1	11/10/24	Adam Kristensson	All	Template created
V1.0	15/12/24	Kristensson, Pagels, Rex and Nilsson	All	Draft version for WP leader review
V2.0	21/12/24	Kristensson, Pagels, Rex, Salas Ventura	All	Revised complete version
Final	23/12/24	Pagels, Rex, Salas Ventura	All	Final input

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