Decarbonization of the maritime sector

HEAD UP services

At **Head Up**, we contribute to the decarbonization of the maritime sector and ports, complying with IMO regulations on NO_2 and CH_4 emissions. We are transforming the Mediterranean into an Emission Control Area and providing hybridization solutions to OPS (Onshore Power Supply) for a cleaner future in ports.

As the maritime sector faces challenges related to sustainability, stricter regulations have been implemented to control pollutant emissions and protect the marine and coastal environment.

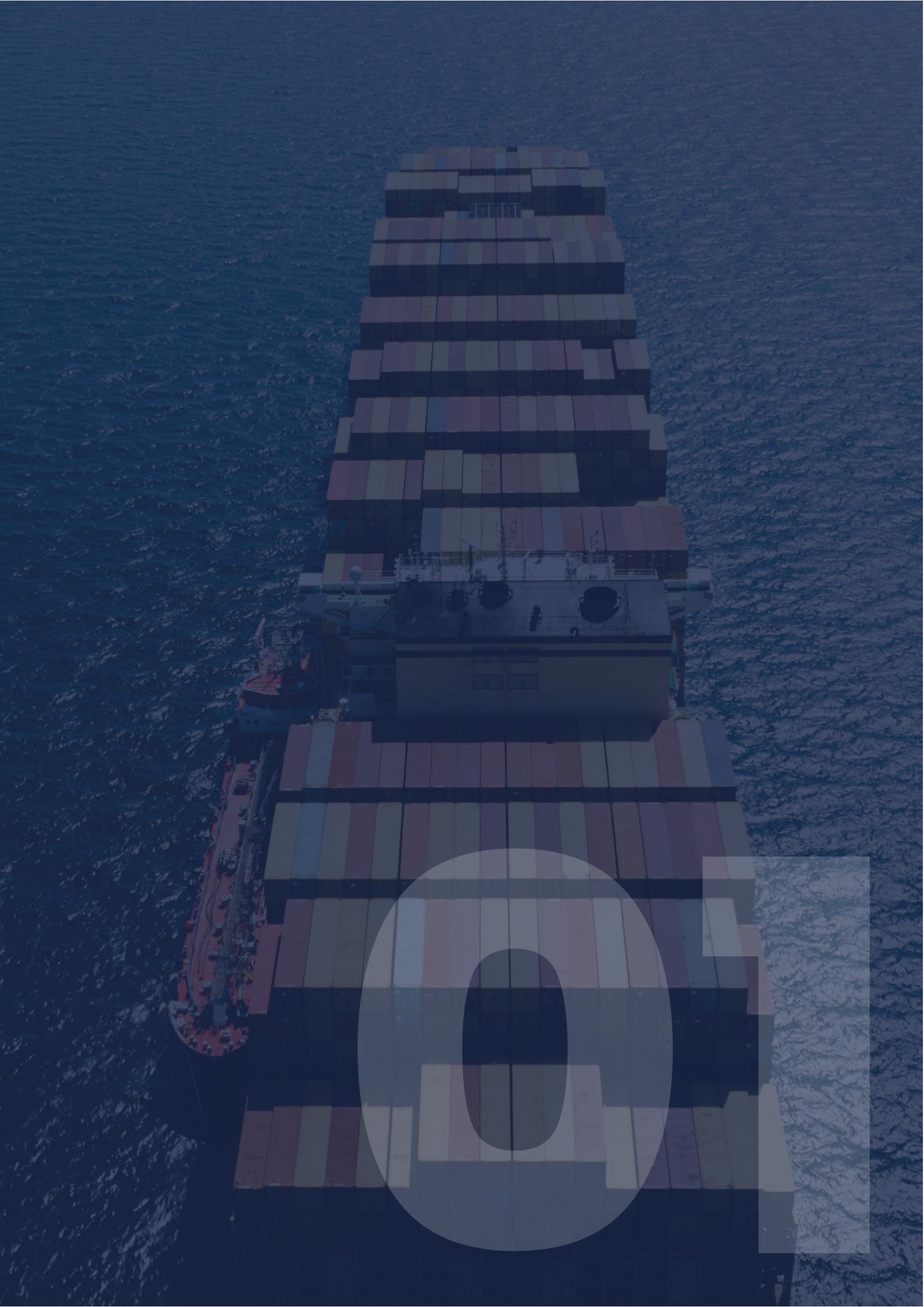
1 - Regulation for monitoring NO_2 and CH_4 emissions (nitrogen oxides and methane):

- Since 2024, **Annex VI of the MARPOL Convention** has reinforced regulations for the monitoring and reporting of NO_2 and CH_4 emissions. This measure is part of the IMO's strategy to reduce maritime sector emissions by at least 50% by 2050, compared to 2008 levels.

- Large vessels must report their emissions through the IMO's **Data Collection System (DCS)**, which covers various pollutants, including CO_2, NO_2, and CH_4.

2 - Mediterranean as an Emission Control Area (ECA):

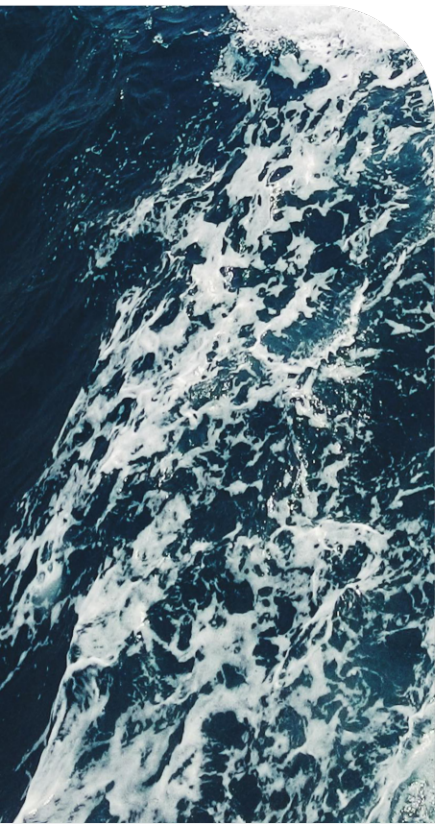
- **Starting in June 2025, the Mediterranean Sea** will be designated as an **Emission Control Area (ECA)**, limiting SOx, NOx, and fine particle emissions. Ships will be required to use fuels with a maximum sulfur content of 0.1% or adopt emission reduction technologies, such as exhaust gas scrubbers.



CatEMission specializes in offering advanced solutions for emission reduction in a world that is embracing more sustainable fuels. With an innovative approach tailored to new environmental challenges, its catalytic technology addresses the changing needs of the maritime industry.

CatEMission promotes environmental innovation by developing **catalytic solutions** specifically designed to address the **emerging pollutants** associated with new fuels like LNG, ammonia, and methanol. Although these fuels are cleaner compared to traditional ones, they generate new types of pollutants and greenhouse gases that require a specialized approach for their control and reduction.

Through **advanced technologies**, CatEMission offers custom-made catalysts that tackle these challenges, mitigating the environmental impact of engines powered by novel fuels. With this solution, the goal is to significantly **reduce the environmental footprint** of these new energy sources, contributing to a cleaner and more sustainable future.



Diesel oxidation catalyst - DOC

Prepare for decarbonization

CatEMission's Diesel Oxidation Catalyst (DOC) system is a state-of-the-art solution for significantly reducing harmful emissions from diesel engines and industrial flue gases. The system employs a catalytic converter that promotes the oxidation of exhaust gases.

Components ensuring cleaner emissions and contributing to the efficiency of the downstream process – pollution control systems.

CO2

DOC System - Reduction Standard

KEY BENEFITS

1. **Effective Emissions Control:** Converts carbon monoxide (CO), hydrocarbons (HC), and VOCs into carbon dioxide (CO2) and water, effectively reducing pollutants.

2. **Customizable substrates:** Available with ceramic, silicon carbide, or metal substrates, designed to fit any specific vessel and reduction levels.

3. **Odor reduction:** The oxidation process significantly reduces the odor of diesel emissions, contributing to a more pleasant environment.

COMPLIANCE

The DOC system is specifically designed to help meet strict emissions standards.

CERTIFICATIONS AND APPROVALS

PGM (Pt / Pd / Rh) / WASH RECIPE: Adapted to each application, ensuring optimal performance and longevity.

The system has been rigorously tested and proven to achieve significant reduction in hydrocarbons (HC, PAH), VOCs, and CO.

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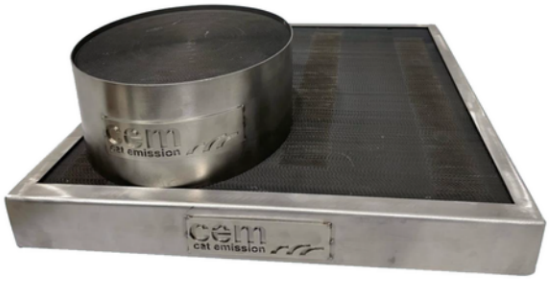
Methane Slip Catalyst - MSC

Prepare for decarbonization



The CatEMission Methane Slip Catalyst System is an innovative solution designed to address methane slippage, a potent greenhouse gas, from gasoline / dual-fuel engines. Leveraging catalyst oxidation technology, this system is instrumental in significantly reducing methane emissions in marine and industrial applications.

CH_4 METHANE SLIP

KEY BENEFITS

1. **High Efficiency Methane Reduction:** Capable of reducing methane emission levels by up to 95%, ensuring a significant decrease in environmental impact.

2. **Advanced Oxidation Technology:** incorporates platinum group metal (PGM) oxidation catalyst substrates to achieve a high rate of methane oxidation within operating temperatures of 350ºC to 500ºC.

MARKET SEGMENTS

MARINE: Designed for application on large marine and cargo vessels, this system helps to comply with strict environmental regulations while sailing around the world.

INDUSTRIAL: Suitable for compact power generation and biogas treatment facilities, ensuring methane emissions are controlled even in the most demanding industrial environments.

COMPLIANCE

The system is designed to meet and exceed legal regulations on methane emissions, providing an environmentally friendly solution for CH4-containing exhaust gases and eliminating NOx emissions.

R+D PILOT SLIDE CATALYST ON A CRUISE SHIP

Objective
- Evaluate the CH4/HC/CO reduction efficiency trend to confirm laboratory results.

PROTOCOL
- Operation only during the burning of LNG fuel
- Continuous monitoring of CH4/ HC/CO
- Significant data anticipated after 600 hours

MONITORED PARAMETERS
- Total Uptime
- Reactor temperatures and pressure
- CH4/HC/CO concentration
- Exhaust gas flow

TEST PARAMETERS
- Catalyst cell density 200-300-400 CPSI
- Various PGM formulations and wash
- Temperature 350º to 450º

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Selective catalytic reduction standard

Prepare for decarbonization

The SCR CatEMission Compact CEMNOx system is a state-of-the-art solution for selectivity Catalytic reduction, using advanced DeNOx. Catalysts to efficiently reduce NOx emissions in exhaust gases. It is designed to operate in a wide range of temperatures, with a urea. Solution injection process optimized for both. General and marine applications.

SCR System - Reduction Standard

KEY BENEFITS

1. **Airless Urea Injection:** Our state-of-the-art airless injection method simplifies the system while improving performance, eliminating the need for compressed air supply.

2. **Substrates Metal SCR Catalysts:** Cemnox ensures longevity and keeps back pressure low, setting new benchmarks in the industry.

3. **Integrated Control Cabinet:** It features a compact dosing and control cabinet equipped with a reliable SIEMENS PLC.

4. **Ultra-compact size:** total length less than 2 meters, including mixing section.

COMPLIANCE

Designed to achieve current European MCPD and NRMM levels for industrial applications.

Complies with strict IMO Level III maritime standards.

CERTIFICATIONS AND APPROVALS

BUREAU VERITAS
Shaping a World of Trust

Certified EIAPP available for various engine models

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Diesel particles DPF filter

Prepare for decarbonization

The CatEMission DPF diesel particulate filter is an essential component for the reduction of particulate matter in diesel engine exhaust gases. It operates by physical filtration, employing a "wall flow" filter design, effectively capturing soot particles that the DOC diesel oxidation catalyst is not oxidized in.

CO2 **DPF Particulate Filter**

KEY BENEFITS

1. **Efficient filtration:** Uses "wall flow" filtration technology to capture larger particles, ensuring cleaner exhaust emissions.

2. **Catalytic Coating:** It comes with a catalytic coating (PGM) that initiates passive regeneration from 320°C, while maintaining the efficiency of the filter.

3. **Regeneration Options:** Features diesel burner or electric heater options for thermal regeneration, along with active / passive regeneration capabilities for low - temperature operations.

4. **Cleaning on board:** Equipped with cleaning facilities on board, including support for DPF and vacuum cleaner, allowing both external and internal maintenance to be carried out without disassembling the elements.

5. **Versatile CPSI Range:** Typically available in 100-200 CPSI, catering to various engine requirements.

COMPLIANCE

The DPF is designed to meet current European MCPD and NRMM levels for industrial applications, complying with strict environmental standards.

Emissions solutions Advanced SCR

Prepare for decarbonization

SCR System - Advanced

CEMNOx stands as the pinnacle of Cat-EMission technology, overcoming the traditional challenges of SCR technology, with a compact and highly effective solution for motors up to 1Mw, and scalable configurations for larger applications (not limitations).

KEY BENEFITS

1. **Durable catalysts:** Equipped with abrasion-resistant and long-operating metal substrates. Also available with ceramic substrates and special chemical coating for high temperature (>480 ºC).

2. **Optimal NOx Reduction:** Patented design, fouling-free bi-fluid lance for optimal atomization of reagents.

3. **Acoustic advantage:** The SCR system also acts as a silencer, with FEM acoustic studies available to demonstrate its noise reduction capabilities.

4. **Customization:** Offers ceramic, silicon carbide, or metal substrates, with CPSI from 50 to 600. The shape of the catalytic converter is customizable according to specific needs.

5. **Efficient Design:** Highly configurable to suit various operational and installation scenarios while maintaining a compact size.

COMPLIANCE

Designed to achieve current European MCPD and NRMM levels for industrial applications.

Complies with strict IMO Tier III maritime standards.

CERTIFICATIONS AND APPROVALS

BUREAU VERITAS
Shaping a World of Trust

Certified EIAPP available for various engine models


02

ECOSPRAY®
technologies for the planet

Ecospray is a leader in developing advanced technologies for emission filtration and reduction, offering effective solutions for exhaust gas treatment across various industries, including the maritime sector, agriculture, and waste management.

With a focus on **sustainability**, Ecospray has developed innovative systems capable of **reducing key pollutants** such as SOx, NOx, particulate matter, and greenhouse gases. These solutions are designed to tackle the challenges posed by new fuels like LNG and biomethane, ensuring a reduced environmental impact while complying with the strictest emission control regulations.

Through its technologies, Ecospray addresses the needs of a world seeking cleaner energy sources, ensuring **a balance between performance and environmental responsibility**.

SCRUBBERS - Gas cleaning systems

Prepare for decarbonization

Our advanced Marine Diesel Engine Exhaust Gas Cleaning (EGCS) systems are specifically designed for SOx removal on large vessels, such as cruise ships, ferries, and commercial vessels with single or multiple engines.

A wide range of EGCs to meet all DeSOx needs:

- Open and hybrid loop
- Inline and U-type configuration
- From 1750 to 5000 mm in diameter
- From 5 to 48 MW of nominal power

PERFORMANCE

Make your fleet environmentally friendly with Ecospray's advanced air quality systems: based on a patented multi-pollutant technology, they are available for both repair and new construction, on board any vessel.

SO2 Removal	SO2 (ppm) / CO2 (% v/v) ≤ 4,3
SW Turbidity (DeSOx Tower Discharge)	<25FNU
PHS (after dilution)	≥6,5at4mtfromOB(IMO) ≥6,0atOB
SWPAH (DeSOx Tower Discharge)	< 50 microg/L normalized at 45 t/MW(MCR)/h

WHY CHOOSE ECOSPRAY EGCS?

Ensure constant compliance with IMO standards.

Performance and maintenance, with remote monitoring and advanced lifecycle analysis.

Reduced costs, longer equipment life, and fuel savings.

Verified and certified actions.

Wash Water Filtration System (WWF)

Even if the wash water in our open loop EGCS exceeds all IMO requirements for wash water discharges, WWF drives filtration performance beyond compliance and removes more contaminants from the wash water.

Pollutants, including soot, are always generated during the combustion process of the diesel engine and their amount depends on several factors.

In engine starting, maneuvering, and during operations at low loads, an engine operates in its least effective conditions and is likely to produce black smoke, which may contain ash, metals, and unburned fuel, such as elemental carbon covered by hydrocarbons (all collectively soot).

With washing water filtration:

- Soot, ash, metals, and unburned fuels are removed from the EGCS wash water.
- Surface effects such as milky discoloration, sea foam, surface film are minimized.

Degassing unit
The degassing unit removes air bubbles from washing Water stream from the DeSOx tower, to minimize surface effects on the gunwale and improve the filtration efficiency of the filter devices.

Key features

- Customizable in size, dimension, and shape to fit existing constraints.
- Proven internal geometry for effective gas removal.
- Made of corrosion resistant, available in different materials such as metal alloys or GRE.

PROCEEDS: WHY CHOOSE ECOSPRAY WASH WATER FILTRATION SYSTEM?

Our advanced wash water filtration technology provides improved performance thanks to new components. We consider this to be a key milestone considering the trend of regulation, which prescribes technically effective solutions, but also requires clean water in the discharge.

Applied to EGCS wash water, WWF removes most of the ash and soot washed by the DeSOx tower (typically combining into compounds larger than 20 µm).

WWF is able to achieve a significant reduction of suspended solids in the EGC effluent (up to 70-80% for some compounds), while maintaining the turbidity levels of the wash to water comparable to the inflow of seawater.

It should be noted that there is a significant reduction in other pollutants (such as heavy metals, hydrocarbons and PAHs); which are the main constituents of the solid particles filtered by the system.

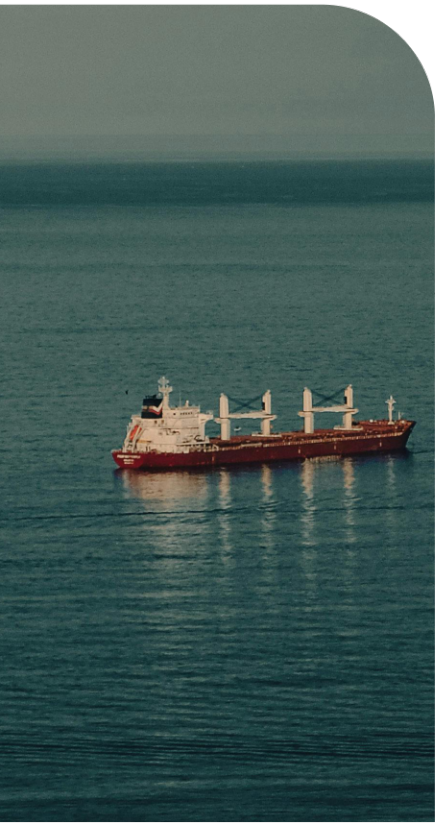
03

H
1,008
HYDROGEN-ERA

The transition towards more sustainable navigation requires innovative technologies that optimize performance and reduce environmental impact. Oxidrogeneras is leading this change with advanced solutions designed to enhance efficiency and comply with the strictest environmental regulations.

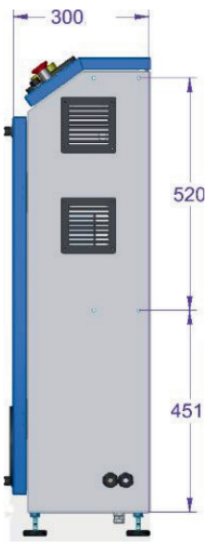
Oxidrogeneras has developed an **advanced HHO gas injection system** that transforms the performance of maritime propulsion through customized manufacturing for each vessel, optimizing its integration without the need for structural modifications thanks to its compact design. The system allows for **a fuel consumption reduction of between 5% and 20%**, which not only decreases operational costs but also facilitates the amortization of the investment. Furthermore, it significantly reduces emissions of key pollutants such as NOx, CO_2, and SOx, **complying with OMI environmental regulations and Thetis MRV.**

The HHO technology ensures safe operation, as it produces gas on demand instead of storing it, and plays a crucial role in **the decarbonization of the fishing and maritime sectors**, offering an efficient, innovative, and sustainable solution that reduces the carbon footprint and ensures more responsible navigation with the environment.



Decarbonisation of the maritime sector

Oxyhydrogen Gas Generators (HHO)



H 1,008
HYDROGEN-ERA

ADVANTAGES

1.

FACILITY

STUDY, INSTALLATION AND MONITORING: We study the situation of each client, and we adapt to their needs. The installation of our equipment is carried out generating the minimum impact and we work on its monitoring to obtain the best efficiency.

2.

PROFITABILITY

EASY TO AMORTIZE: Our goal is to achieve emission reductions and the maximum possible savings in your fuel consumption.

3.

REMOTE MONITORING

TECHNICAL SERVICE AND CONTINUOUS TRAINING: We establish a direct relationship and continuous monitoring of the installed equipment to know what the optimal performance is and its possible improvements and updates. We provide solutions so that your ecological transition is not a problem.

4.

PRODUCTS

WIDE RANGE: We have manufactured different models to suit each type of boat, with one engine, two engines, or one main engine and two auxiliary engines, with the possibility of installing several equipment in series to meet all kinds of needs. We adapt to each customer and carry out a preliminary study to manufacture a machine to suit them.

WE REDUCE: T fumes °C, T air °C, O2%, CO2%, CO ppm, ΔT °C, NO ppm, NOx ppm, P Pametered gas.
By 2025 adjusted to Thetis-MRV and OMI monitoring

D260824 – comercial@headup.es


04

TESVOLT OCEAN

With the aim of promoting the transition to more sustainable and efficient energy, TESVOLT positions itself as a leader in advanced energy storage solutions. The company focuses on technological innovation to maximize performance and safety in various energy applications.

TESVOLT is **a leading company in advanced energy storage solutions**, designed to maximize efficiency and safety in both grid-connected and off-grid applications. Their systems are recognized for their high durability, **with a lifespan of up to 30 years** and a full charge cycle of up to 8,000 times. TESVOLT focuses on industrial and commercial sectors, offering solutions for optimizing self-consumption, reducing peaks, hybrid systems with diesel and PV, among others. Additionally, it stands out for **the flexibility of its systems, which can be easily upgraded or adapted** to new energy needs.

Technologically, TESVOLT incorporates innovative systems with **98% efficiency**, ensuring high performance without compromising power. The company also prioritizes safety, subjecting its modules to rigorous testing to guarantee **safe and reliable operation**. TESVOLT works with both renewable and conventional energy sources, tailoring its solutions to a wide range of applications, from microgrids to control of charging stations.

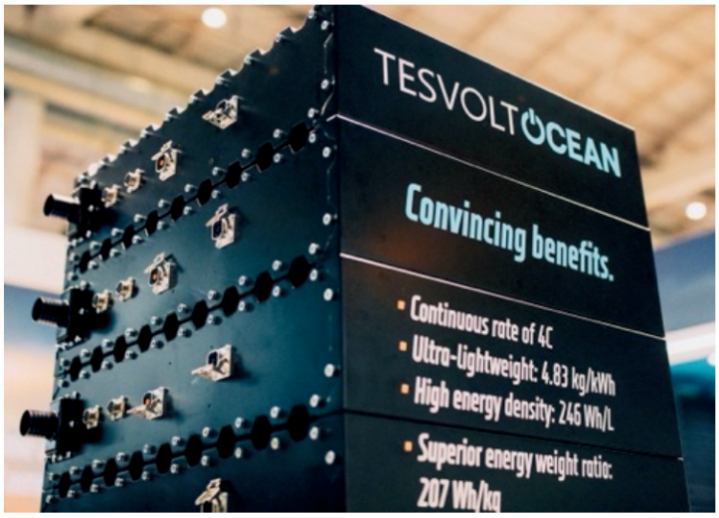
Kaptein NMC datasheet

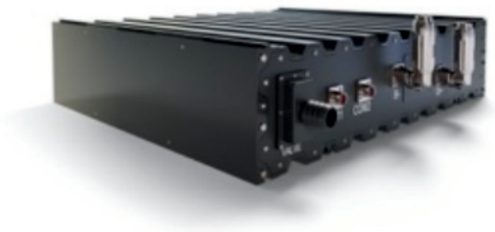
Module (NMC)

Feature	Value	Unit
VCC min.	66,0	V
MAX VCC	104,4	V
Nominal VCC	89,3	V
Gross capacity	16,0	Kwh
Net capacity	12,8	Kwh
Module weight	77,0	KG_o
Module height	162	mm
Module Width	680	mm
Module Depth	584	mm
Module Volume	64,3	l
Volumetric Energy Density	248,2	Wh/l
Gravimetric Energy Density	207,4	Wh/kg
Heat dissipation at 0.1C	3,9	W
Heat dissipation at 2ºC	1,7	Kw
Heat dissipation at 4ºC	6,3	Kw
IP Class	67	
Shock resistance	10	G
Mounting / fixing	"Any angle "free rack"	
Operating Temperature	-20 a +55	ºC
Air cooling		
Liquid cooling (optional)	Recommended to >2C	

Maximum Series Chain Configuration

Feature	Value	Unit
Maximum number of modules in chain (series) 12		PCS
Gross Chain Capacity	191,6	Kwh
Rope Net Capability	153,3	Kwh
Min. voltage chain	792,0	VDC
Nominal String Voltage	1.071,4	VDC
Max. voltage chain	1.252,8	VDC
Charge rate C cont.	4	C
Discharge rate C cont.	4	C
Vegetables	7	C
Weight rope	924,0	KG_o
Energy density gravity metric	4,8	kg/kWh
Volume Chain	776,8	l





TESVOLT OCEAN's new Kaptein battery module combines multiple USPs: in a market comparison, it has the lightest weight, the highest energy density, and the highest C-rate.

Maximum range for boats: With the highest energy density on the market of 246 Wh/l, the Kaptein battery system offers more storage capacity with minimal space requirements.

TESVOLTOCEAN
TESVOLT OCEAN GmbH
MariaGoeppertStraße 3
23562 Lübeck
Alemania
info@tesvoltocean.com | www.tesvoltocean.com

Distribuidor España & Portugal
+34 986 12 41 63
comercial@headup.es
Barrio San Andrés Pontellas, 20 36412 O Porriño (Pontevedra)

HEADUP services

+34 986 124 163 | comercial@headup.es | Barrio San Andrés Pontellas, 20 - 36412 O Porriño, Pontevedra - SPAIN | **headup.es**