

HUG ENGINEERING · MARINE

CLEAN PORTS. NOW.

Emissions from ships at berth, and the technology
that eliminates them today



THE PROBLEM

Pollution everyone can see

In city-centre ports, smoke from ships at berth rises just metres from homes, schools and offices.

You don't need a monitoring station to notice it: just look out of the window.

Image: Rai · HUG Engineering

THE URBAN PARADOX

The city has cleaned up. The port has not.



Road traffic

Ever stricter Euro standards, particulate filters and SCR on cars and trucks.

Sharply reduced



Heating

Switch to natural gas, condensing boilers, heat pumps.

Sharply reduced



Urban industry

Relocation and mandatory flue gas treatment.

Sharply reduced



Ships in port

Diesel generators running for the entire stay, often untreated.

Still significant

WHERE IT COMES FROM

In port, a ship is a running power plant

What keeps running at berth

- Auxiliary generators for lighting, galleys and hotel services
- Air conditioning and ventilation of passenger spaces
- Cold stores and reefer containers
- Pumps, ramps and cargo-handling systems

What ends up in the city's air

NO_x · nitrogen oxides, precursors of ozone and secondary particulate

PM_{2.5} · fine particulate, the visible black smoke

ROG · hydrocarbons and reactive organic gases

THE REGULATORY GAP

Public opinion is moving fast, regulation is not

Shipowners

They must plan fleet investments without knowing which limits will apply tomorrow, and in which ports.

Port operators

They face pressure from citizens and media, but lack clear tools to impose solutions.

Enforcement authorities

There are no operational references on what to check, how to measure it and on what timeline.

The result is waiting. But every day of waiting is another day of smoke over the city.

THE PRECEDENT

California has already decided: CARB At-Berth

The California Air Resources Board requires ocean-going vessels to reduce emissions **for the entire duration of their stay** at regulated ports and terminals.

Power generated on board must be treated by approved systems (CAECS), unless exemptions or alternative pathways apply.

Tankers

Container ships

Ro-Ro

Reefers

TIMELINE

2025– 2027

Implementation deadlines make retrofits and technology investments urgent.

COMPLIANCE PATHWAYS

Three routes, only one always available

Solution	Nature	Strength	Constraint
Shore power	Depends on infrastructure	Power from the grid	Electrified quay required
Barge-based CAECS	External service	Flexible for emergencies	Booking and availability
HUG on board	Built into the ship	Always available	Retrofit installation

With on-board treatment, compliance travels with the ship: in every port, at every berth, without relying on third parties.

THE BUSINESS CASE

On-board treatment costs up to 3 times less

Annual cost for a typical tanker >250 m, 3× 1 MW DGs + 2× 500 kW pumps, approx. 2,000 hours at berth per year, one DG always on standby.

Shore power

€6,000k electricity

CAECS barge

€2,700k barge rental

€1,500k fuel

HUG on board

€400k

€1,500k

fuel

Shore power and CAECS: approx. €1,500/MWh on average.

HUG DPF+SCR+OXI: €500/MWh. CAPEX amortised over 15 years.

THE ABATEMENT CHALLENGE

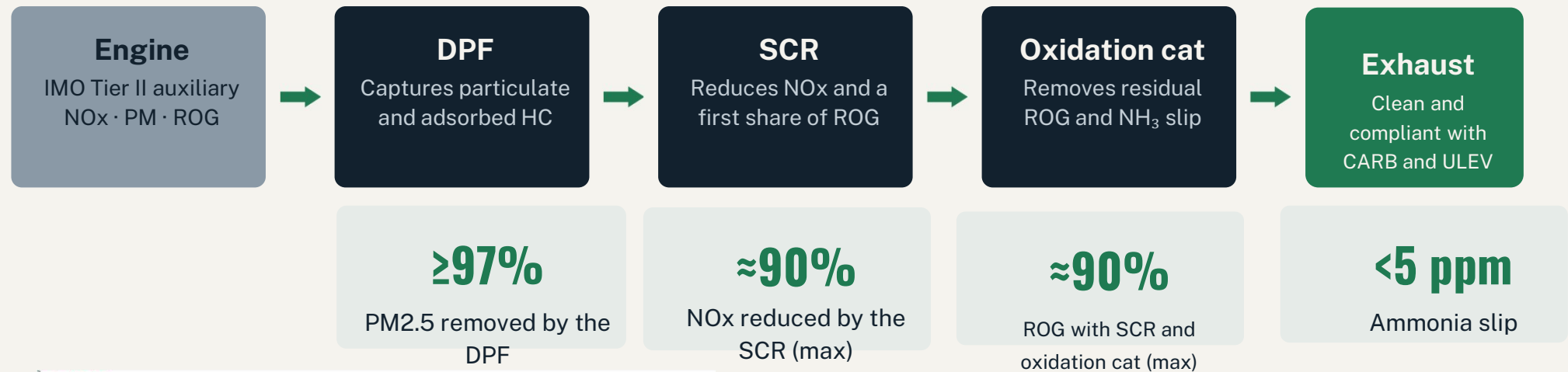
From IMO Tier II to CARB limits

Pollutant	Typical IMO II (g/kWh)	CARB limit (g/kWh)	Technology	Required reduction
NOx	9–11	2.8	SCR	≈75%
ROG	0.52	0.1	SCR + OXI	≈80%
PM2.5	0.15–0.20	0.03	DPF	≥97%

Minimum reduction required to bring a typical IMO Tier II auxiliary engine within CARB limits. Maximum performance of the HUG DPF + SCR + oxidation catalyst system is shown on the next slide. Actual values depend on engine, fuel and operating conditions.

HOW IT WORKS

From raw exhaust to clean exhaust

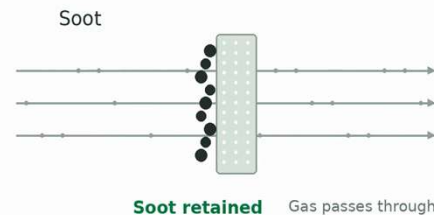


DPF

Captures soot



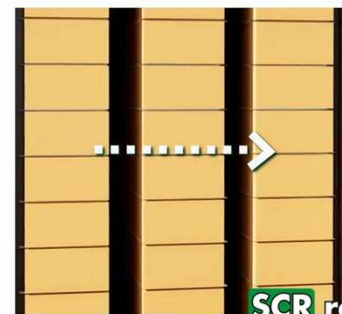
OPERATING PRINCIPLE



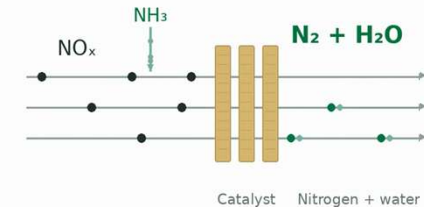
DPF captures soot.

SCR

Reduces nitrogen oxides



OPERATING PRINCIPLE



SCR reduces nitrogen

hugengineering.
We clean emissions

HUG SOLUTIONS

Every source on board has its answer

MAIN ENGINES

SCR

Selective catalytic reduction of NOx, sized for propulsion and integrated into the existing exhaust line.

GENERATORS AND DIESEL-ELECTRIC

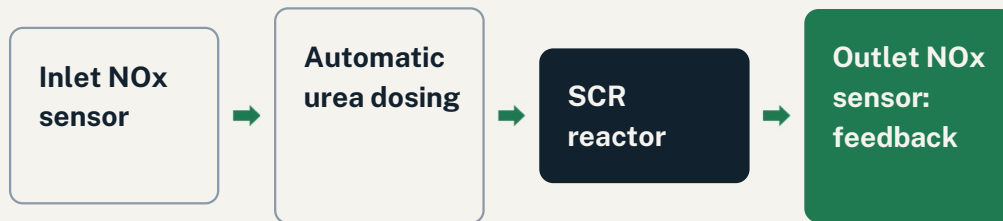
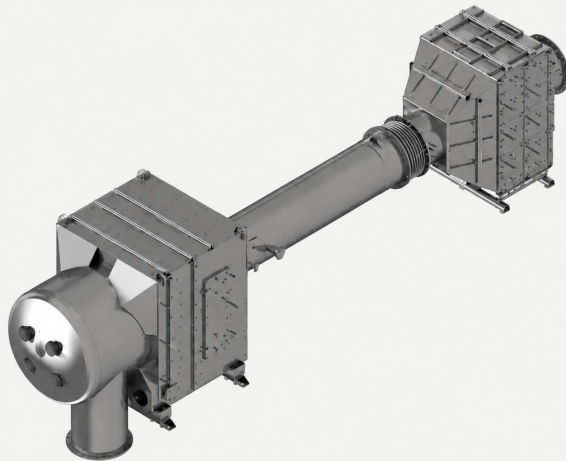
Integrated DPF + SCR

One system for particulate, NOx and hydrocarbons: the direct answer to emissions produced while in port.

In-house design, development and manufacturing, with Swiss engineering and technology proven in marine, power generation and mission-critical applications.

TECHNICAL ADVANTAGE

Closed-loop urea control

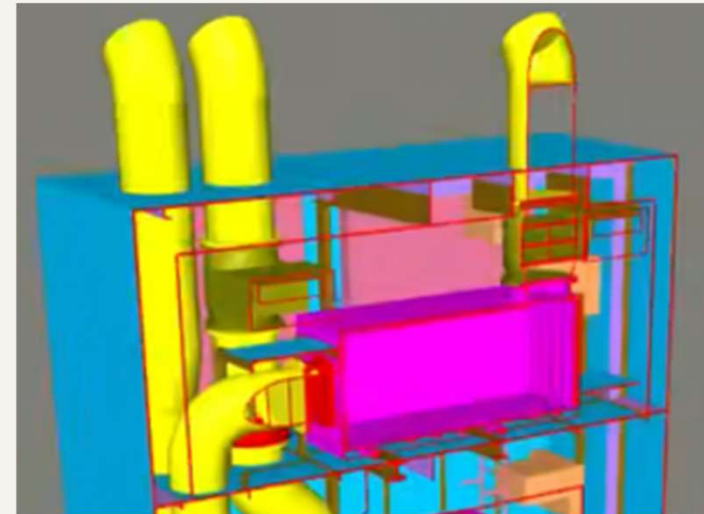


Urea optimised in real time at every load

Reduced maintenance and longer sensor life

Simple commissioning, no annual spot checks

Open integration via multiple protocols



APPLICATIONS

Ready for the ships already at sea

Compact

Designed for engine rooms with limited space.

Modular

Scalable architecture across engine sizes.

Retrofit

Easy integration on vessels in service.

Ferries and Ro-Pax

Ro-Ro

Tankers

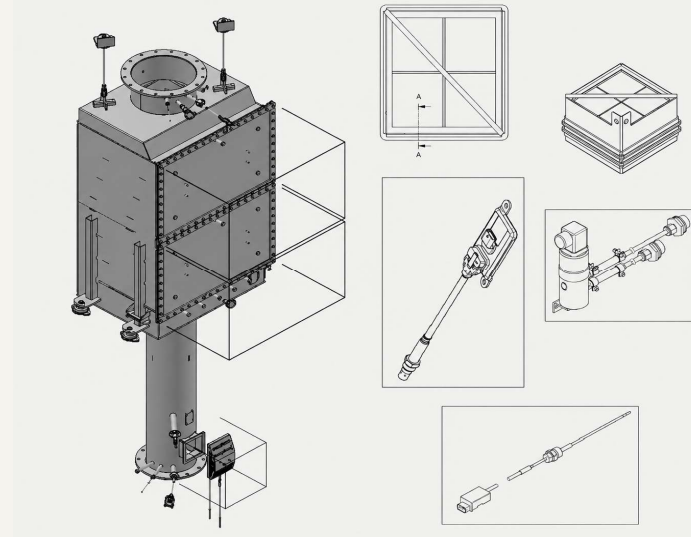
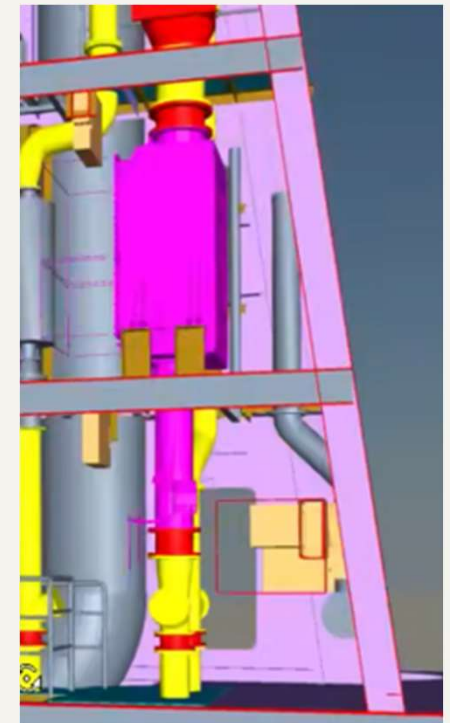
Cargo

Container ships

Port craft

500 kW – 10 MW

Power range for auxiliary engines.



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We clean emissions

CLASS RECOGNITION

DNV introduces the ULEV qualifier

DNV class rules now include an additional qualifier, **Ultra-Low Emission Vessel**, for ships designed with ultra-low emissions of gaseous pollutants and particulate matter.

Based on real measurements: granted on verified test results for each engine.

Stage V reference: engines type-approved under Regulation (EU) 2016/1628 meet the additional requirements.

Excluded: only emergency engines such as lifeboats and fire pumps.

THE KEY FOR PORTS

ULEV mode

Performance can be demonstrated over the full operating profile or in a defined condition, for example while at berth.

HUG DPF + SCR treatment on generators is the direct route to Stage V-type levels in port.

THE MESSAGE

DON'T WAIT FOR A NEW LAW. ACT TODAY.

Delaying means exposure

Regulatory risk when the rules arrive.
Environmental risk for those living next to the port.
Reputational risk with citizens and customers.

Acting today means

Protecting port cities.
Getting ahead of the rules instead of reacting to them.
Proving that clean shipping is already possible.

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TECHNOLOGY ALREADY IN SERVICE

ULEV achieved with HUG on 8 MW medium-speed engines

Not a prototype: HUG technology already in operation on some of the world's most advanced vessels.

JACK-UP INSTALLATION VESSEL

8 MW medium-speed engines treated with HUG systems: ULEV target achieved.



CABLE LAYER

8 MW medium-speed engines treated with HUG systems: ULEV target achieved.



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GETTING STARTED

From assessment to commissioning

01

Technical assessment

Engine data and ratings,
preliminary compliance check,
retrofit pathway.

02

Feasibility

Available space, installation
analysis, preliminary system layout.

03

Tailored proposal

Indicative CAPEX, 3D layout,
delivery times and compliance
roadmap.

Request your technical assessment today

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