

# NAVIGATING A ROUTE TO NET ZERO Energy efficiency first - then new zero-carbon fuels

#energy #efficiency #projects
#EEXI #CII #FUELEU
#2025 #modern #shipyard
#RealAction



For Inspiration,
please find in this folder a collection of
Energy Saving Initiatives



# 13 CLIMATE ACTION



# Climate change is one of the biggest sustainability challenges of our time.

At FAYARD we have a strong focus on supporting customers regarding the CII and the EEXI improvements, and in optimizing the ships in operations by incremental retrofits.

We are thrilled to work together and to help our customers become more efficient while reducing the vessels' environmental footprint.

QUALITY ON-TIME ALWAYS



# **FUELEU MARITIME**

From 1. January 2025, Ships above 5,000GT transporting Cargo or Passengers for commercial purposes in the EU/EEA(ex Norway and Iceland) are required to meet annual Well-to-Wake Green House Gas (GHG) emission intensity requirements.

#### Note the rewarding factors:

- Use of Shore Power\*\*
- Use of certain renewable fuels
- Use of Wind Assisted Propulsion System (WASP)
- \* The GHG intensity applies to
- 100% of energy used on voyages and Port Calls within the EU/EEA
- 50% used on voyages to or from ports in the outermost regions of an EU/EEA member state
- 50% used on voyages into or out of the EU/EEA.

60%+ of the grid power in Denmark is generated from Wind and Sun.

When you demand 100% renewable power in the shore connection, we can still deliver.

EU's FuelEU Maritime requirements to the reduction of the 2020 avg. GHG intensity 2% from 2025 to 2029.

6% from 2030 to 2034, and accelerate from 2035 to 80% reduction in 2050

# Cost effective saving potentials:

- LNG and Bio-LNG offers lower GHG Intensity than required until 2035
- Energy-Efficiency measures
- Wind assisted propulsion (WASP)
- Shore Power when possible
- Compliance pooling

<sup>\*\*</sup> At FAYARD, we can provide shore power to nearly all requirements. Our Shore Connections converts power from the grid to your needs.



# CII - an ongoing effort!

## Continuously lowering the Emissions on the road towards Zero Emissions

### Carbon Intensity Indicator (CII) 2023 -> 2030 (IMO)

The **CII** requirements is in force for **all** Cargo, RoPax and Cruise vessels above 5,000 GT and trading internationally. The Carbon Intensity Indicator (CII) is a measure of how efficiently a ship can transport goods or passengers and is given in grams of CO2 emitted per cargo-carrying capacity and nautical mile, based on reported IMO DCS data.

The **CII** addresses the actual emissions in operation.

IMO's target for **2026** is a **11% reduction** of vessels' CO2 emission

#### **Actions:**

- Shaft Limitations
- Engine Power Limitations
- Install Energy Saving Devices
- Convert to Low Carbon Fuel
- Increase vessel capacity
- And many more...



# 13 CLIMATE ACTION



# **Energy Saving Devices (ESD)**

# Innovative Solutions & **Incremental Improvements**

for reducing emission to air by less consumption

# Find the right solution to stay compliant and efficient.

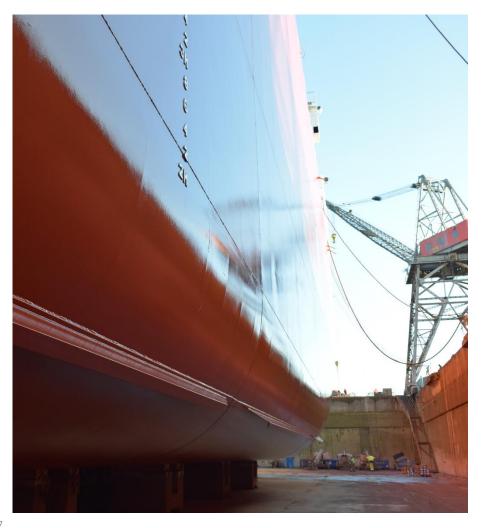
Our examples on the following pages are available to all

- have low OPEX
- fast to implement

**ALWAYS** 







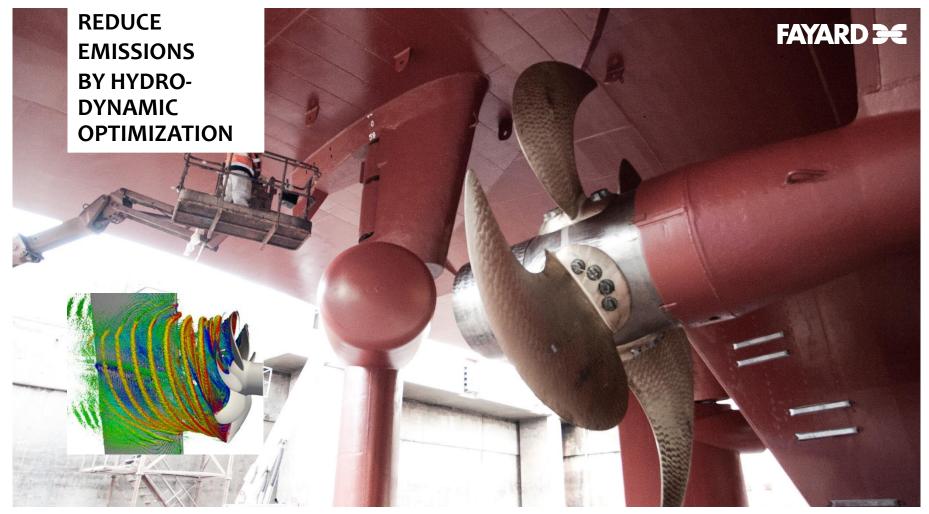
# **Silicone Antifouling**

- Reducing resistance on the hull creates significant savings of fuel
- FAYARD meets the higher applying demands this paint system requires:
  - Special equipment needed, including heated sprayers
- Special processes needed with high level of documentation and accuracy
- Latest projects are made with Hempadur X7 & X8

Clean Hull = Less Emission

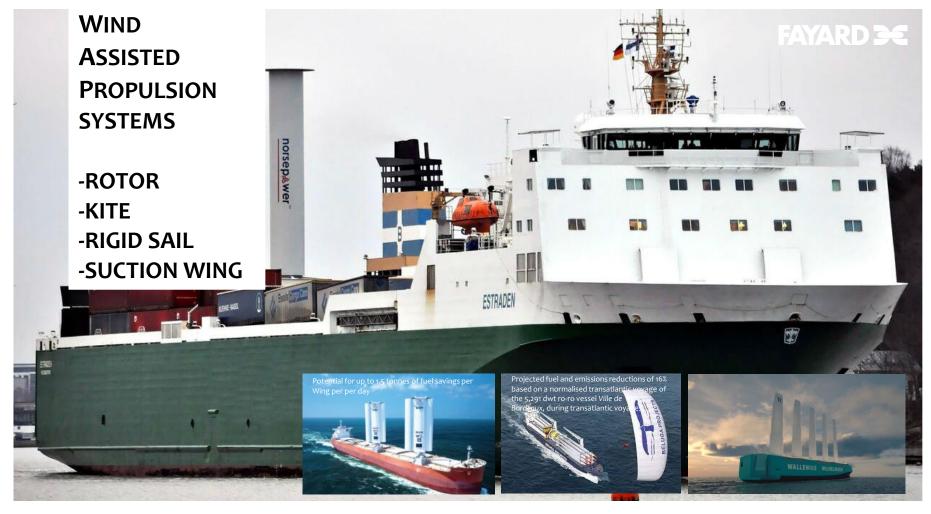














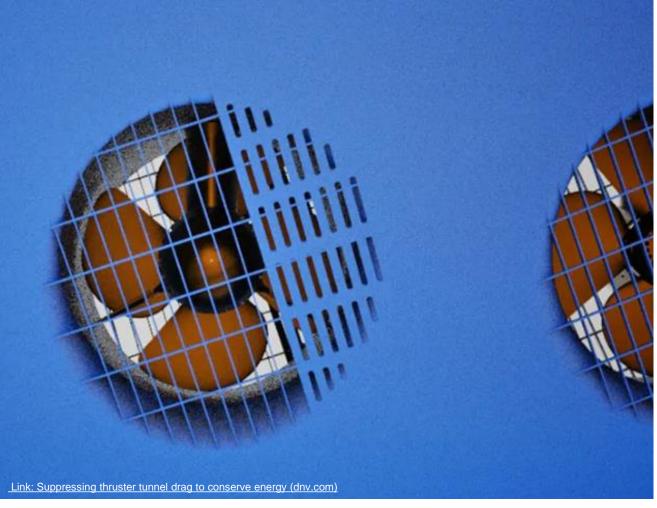


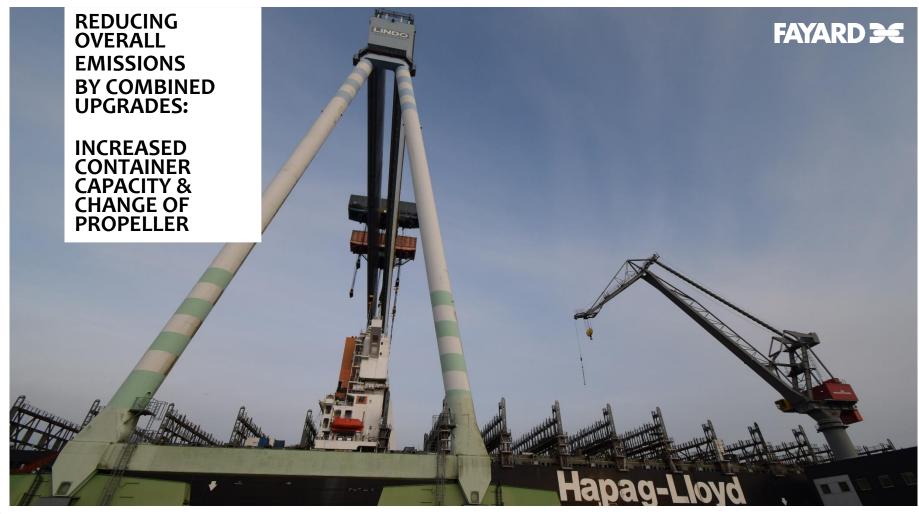
# REDUCE EMISSIONS BY SUPPRESSING THRUSTER TUNNEL DRAG. ONE EXAMPLE FOR YOUR INSPIRATION

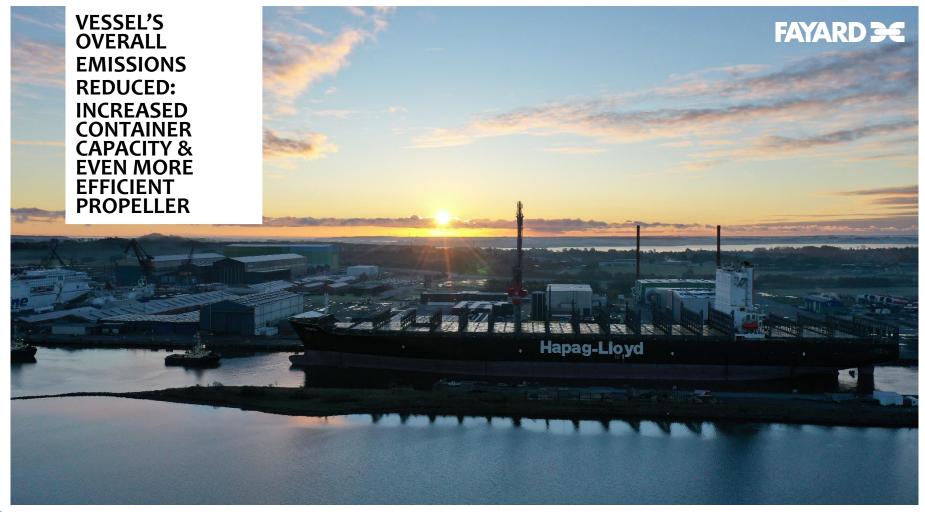


DNV AND FINCANTIERI ARE
DEVELOPING A HYDRODYNAMICALLY EFFECTIVE
SOLUTION NOW AVAILABLE FOR
THE MARKET.

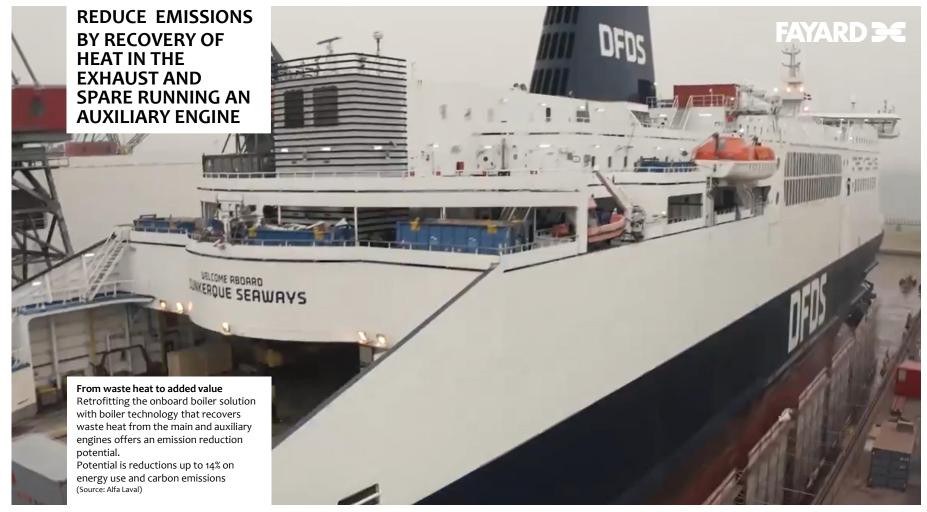
FINCANTIERI'S PATENT-PENDING SOLUTION CONSISTS OF A SPECIALLY DESIGNED GRID AND A HINGED, SLOTTED DEFLECTOR COVERING THE FORWARD PORTION OF THE TUNNEL.











REDUCE EMISSIONS
BY RECOVERY OF
HEAT FROM THE
EXHAUST AND/OR HT
WATER, AND
USE IT FOR COOLING
OF THE
ACCOMMODATION

By recycling the ship's thermal waste energy and utilizing it for heat-driven cooling, the ship's amount of fuel generated electricity used for cooling can be reduced by over 90%.

The COOL4SEA technology utilizes the ship's waste heat for cooling of Crew Quarters, Service Areas, Energy Storage System etc.

The technology is based on the unique and patented "Active Spray Absorption" cooling and developed specifically for use on ships.

The technology is 100% automatic and adapts to variations in the temperatures and flows.

- Water is used as refrigerant.
- No additives.
- High operational reliability
- Practically no maintenance.

The only essential requirement is simply that the technology's key processes can be connected to three external circuits.







# **Control your consumption**

Controlling of e.g. cooling pumps / ventilation fans' speed etc. using e.g. actual monitored temperatures, pressure, torque, volume or ...

Actual demand operation versus on/off approach

- Less fuel consumption causes less GHG.
- Less wear and tear.
- Less noise onboard.

FAYARD has installed several solutions for this purpose, all having a short return on investment for the Owner, and at FAYARD, we use flow control ourselves in our Dry Docks for filling and emptying.

Saving potential is related to specific vessel and its major operational area.

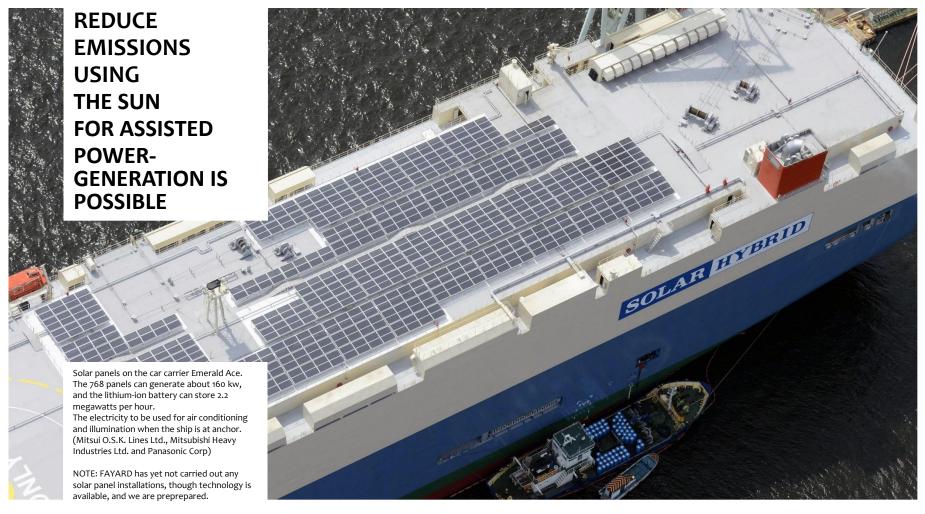
Roughly the average saving potential is app. 300t CO2 per vessel per year.





# **LED Lights**

- Replacing the lights onboard with low energy consumers as e.g., LED lamps not reduces the power consumption reflecting lower GHG emissions
- LED lamps also reflect lower heat generation and by such reduces the HVAC requirement.
- Relevant for especially Cruise, Ferries, PCTC vehichles carriers, RoRo vessels etc.





# 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



# **HYBRID Energy Storage Systems**

for reducing emission to air

**Selected Case Stories** 

QUALITY ON-TIME ALWAYS

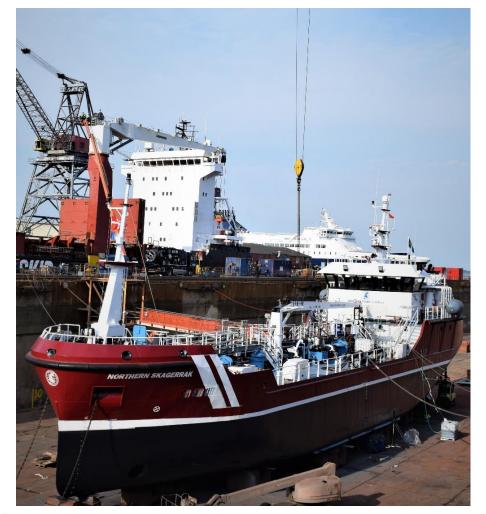




# **Hybrid Energy systems**

- Vessels are dependent on always having enough power for vessel operation in all terms
- When one single solution is not the right approach, the securing of the propulsion can be achieved combining more state-of-the-art solutions into one Hybrid Energy system
- At FAYARD we have teamed up with Owners in a wide range of system combinations to achieve the most suitable Hybrid Energy systems for specific vessels:
  - Emission hybrids
  - Fuel system hybrids
  - Power generation hybrids
  - Energy Storage Systems
  - And more to come

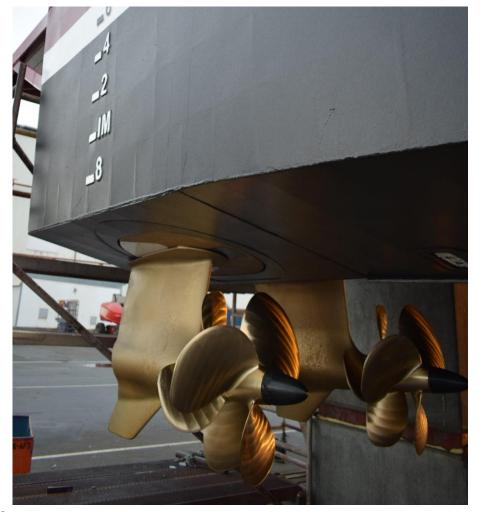




# **Parallel Hybrid Transmission**

- The Northern Offshore Service's Bunkering Tanker is dependent on always having enough power for vessel operation in all terms
- Also, the vessels are required to be compliant to various port restrictions for emission as well as a Owner driven dedication to lowering the overall fleet footprint.
- At FAYARD we have installed Northern Offshore Services' newest hybrid solution: Parallel Hybrid Transmission (PHT). The PHT-solution consists amongst others of:
   Esco Power PHT module installed between the diesel
  - Esco Power PHT module installed between the diesel engine and the gearbox
  - Esco Power Hybrid Electrical Solution Package (HESP). HESP consisting of efficient electric motors and generators, electronic control and command system, control levers, screens, and software to benefit from various operation;
    - propulsion modes: diesel electric automatic and additional modes as: generator–back up–cross feed.
  - ZEM Battery system
  - ZEM Charging system
  - Step up/down transformer





# **Hybrid Energy systems**

- The Northern Offshore Service Vessels are dependent on always having enough power for vessel operation in all terms
- Also, the vessels are required to be compliant to various port restrictions for emission
- At FAYARD we have assisted Northern Offshore Services for upgrading the vessels to HYBRID operation, Diesel and/or Electrical propulsion made possible.
- 4 x Volvo Penta D13-700 DST (Tier 3) engines
- 4 x Volvo Penta IPS900 Q2 props
- ESS made ready for to allow charging by shore power for emission free sailing





## Plug-in Hybrid

#### Color Line's "Color Hybrid"

#### - World Largest plug-in Hybrid Ship in operation from 2019

The ship has full battery operation in and out of the fjord to Sandefjord inner harbor. The ship therefore does not emit emissions to air from harmful environmental gases and

the noise is significantly reduced. At 100 m distance to the ship, the noise corresponds to a normal conversation between two people.

Passengers 2000 Crew 100 Cars 500

Batteries (ESS) 5MW equal to app 6omin maneuvering

at o-12 knots

Power generation 4 diesel electrical engines &

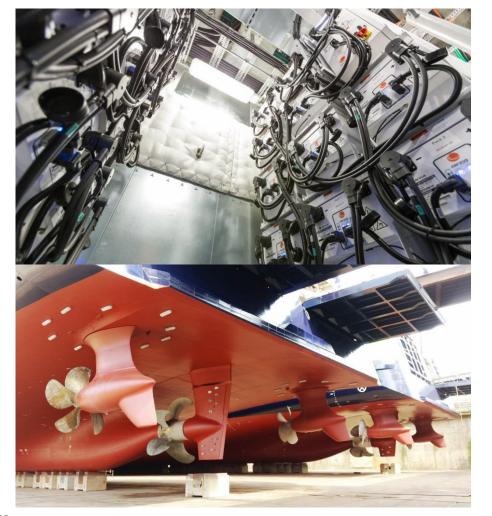
Waste Heat Recovery System

Drives 2 CP propellers (16.8MW Mcr)

#### Onshore power plants for Shore Connections

The company has been a driving force in the establishment of onshore power plants in Norwegian ports. Oslo in October 2011. Kristiansand in 2014, Larvik in 2016, Sandefjord in 2017 and Kiel 2019

Total annual CO2 emissions are reduced by about 8 000 tons CO2. In addition, the local environment is saved for large point emissions of NOx, SOx and particulate matter, as well as a significant reduction in noise when the ships are docked.



# Electrical – Electrical Propulsion



#### **HYBRID Options**

- Diesel Emission controlled by closed loop Scrubbers
- Diesel Electrical Emission controlled by closed loop Scrubbers
- Electrical Electrical Zero Emission from the propulsion

Scandlines is the first ferry operator in the world introducing a large scale hybrid system, which can store excess energy in batteries on board.

Scandlines' visions of sustainable ferry services go even further. The ambition of the green strategy is ultimately **zero emission**; that is, a propulsion system for the ferries without any emissions.

A key goal is to optimize the fuel consumption of the two new ships for Rostock-Gedser – and to comply with applicable environmental requirements.

This is done by Scandlines' award-winning hybrid propulsion system and by exhaust gas cleaning solutions (closed loop scrubbers), which reduce the Sulphur emissions by at least 90 percent and thereby comply with the 2020 standards for Sulphur limits.





## DOF CARRIED OUT THE HYBRID CONVERSION OF SKANDI MONGSTAD AT FAYARD

DOF's Skandi Mongstad went to FAYARD for conversion early 2018.

The conversion for battery hybrid operation is now required under contracts awarded by Equinor: All vessels to be equipped with hybrid battery operation, and the possibility of

shore power connection. This will allow the vessel to reduce fuel consumption while working in dynamic positioning mode.

Equinor says, that with an ambition of being a leader in carbon-efficient oil and gas production, it is focusing on reducing emissions from its logistics activities. The contract requirement will allow to focus on optimizing our operations to continuously improve operation, safety and energy efficiency.

Hybrid propulsion that combines electric drives, diesel generators and batteries can make offshore vessels more fuel efficient, reducing fuel consumption, CO<sub>2</sub> emissions and enhancing the level of redundancy onboard.

Batteries also smooth the load by compensating for peaks and troughs, as well as enhancing safety and reliability by providing back-up in the event of blackouts.

The ability of battery-based Energy Storage Systems to provide peak shaving, power smoothing and power for dynamic positioning operations, features are especially applicable to OSVs.



# AFFORDABLE AND CLEAN ENERGY



## **SHORE TO SHIP POWER**

**Alternative Marine Power (AMP):** 

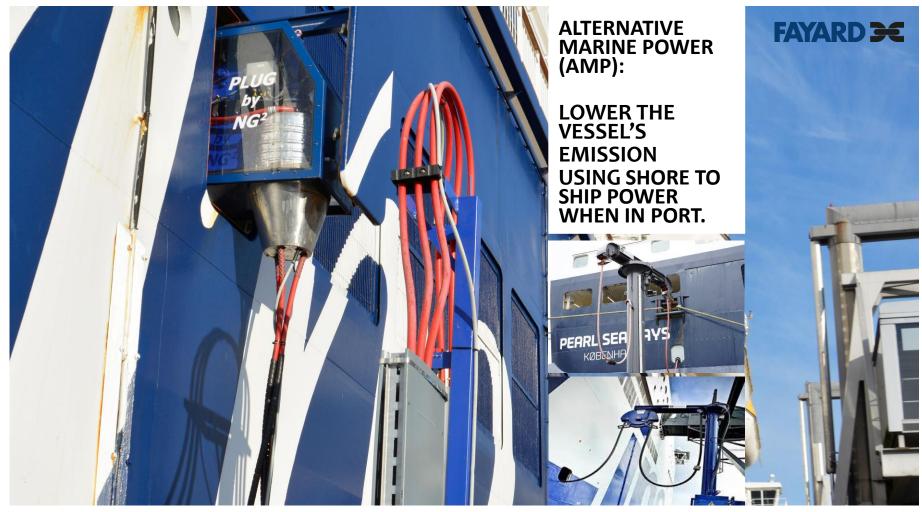
# FAYARD's SHORE CONNECTIONS

Reducing emissions to air when in Port, at lay-up and when at FAYARD.

In 2022 59.3% of the electrical power in Denmark was generated from the Wind and the Sun.

AMP made possible by FAYARD's solution

QUALITY ON-TIME ALWAYS



## Innovative SHORE TO SHIP POWER – AMP

FAYARD 🕦

Most vessels have shore connecting equipment allowing power supply from ashore when in port or yard.

For the onshore supply of power to the vessel, FAYARD and Danfoss have developed the "Clean Power" shore supply system.

At FAYARD we naturally use the solution having 10 systems in use
2022: 59-3% of Provided electricity was generated in Denmark from the Wind and the Sun.

We sell, rent, lease the solution to Ports and Owners in need for the right Shore to Ship interface between the domestic onshore power grit and the vessel.





Solving the shore supply challenge When in dock, ships rely on shore stable, and is characterized by many peaks, presenting a major efficiency challenge. Supplying enough power to meet these peak demands, while power consumption, is a difficult

a large reserve supply.

The solution for FAVARD A/S shipward in Denmark was to convert from a dieselgenerator based to an electric shore supply system using VACON® NXP Air

Before: Costly to run EAVARD A/S is a modern repair ward length and 90 m breadth. Here all types of maritime vessels can be

Before 2010, when ships were in dock the electrical shore power supply was power to the 60 Hz grid on board the ship. Unfortunately they were costly to run, since the rotating converters of 1000 kWh per day due to mechani-

2 Danfoss Drives - DRDD PC-912 A1 03

For larger ships, the power was supplied by portable diesel generator se which were leased for each project. 800 litres of fuel ner day Efficiency was ran at extremely low loads most of the

ovesen, is very familiar with these

few failures, and any malfunctions have

peen promptly solved by the service

Therefore Jesper Gravesen did not

VACON\* drives to find an alternative to

the rotating converters and the diesel

tion engineering team he built a pilot

■ A VACON® NXC Air Cooled drive to

A sine-wave filter to create a nea

A separation transformer to elimi-

nate common mode noise and

convert the 50 Hz shore power to

drives. He has experienced only very

After: High-efficiency electric systems FAYARD has an installed base of 25 portable shore power systems, each large VACON\* AC drives on site, There e the electrical supervisor, lesper at 440 V or 300 A at 690 V

> on the deck of a ship, or at the quay side depending on the vessel and th

tion, the two systems can operate in parallel, on board the same vessel. Alternatively, they can be used as stand-alone systems for two different

Payback in two months The energy savings are impressive. The standby losses per system are reduced to less than 50 kWh per day, and efficlency is typically above 90% with an

average load profile

were far lower than for the existing sy share power systems

> Maintenance of the generators no longer being required Due to the good experience with the built another system in 2013. The total

shore power capacity is now 1500 A In spite of the turbulent business conditions in the marine and offshor industry, FAYARD has been operating 75-80% capacity over recent years. The ner year on average

The payback period was calculated to

be less than two months, based on

Reduced energy cost. The fuel cost for each diesel generator was

approximately 43k € for a 40-day

Elimination of leasing cost for diesel

Shore supply system configuration

This illustration shows the typical configuration for a shore power supply application

Reduced emissions and acoustic noise

As an extra benefit, the working enronment at the shipvard has improve with better air quality and reduced noise. FAYARD is in the process of in plementing an ISO 14001 environme tal certificate and it is very importan for the yard to validate the green company profile. These documented noise provide the much-needed pro









VACON® NXC drives FAYARO has been pleased with the fast service response from the local support team. Usually however, the shipyard performs much of its own maintenance and does not often use We have also recently installed

VACCON® NXC drives to maintain the water pressure on our firefighting systems, which resulted in great savings. We have also installed VACON NXC drives on two 400 kW sea water can empty the dock in just 4 hours. The next investment is to replace two old pumps with new 105 kW pumps, also egulated by VACON drives

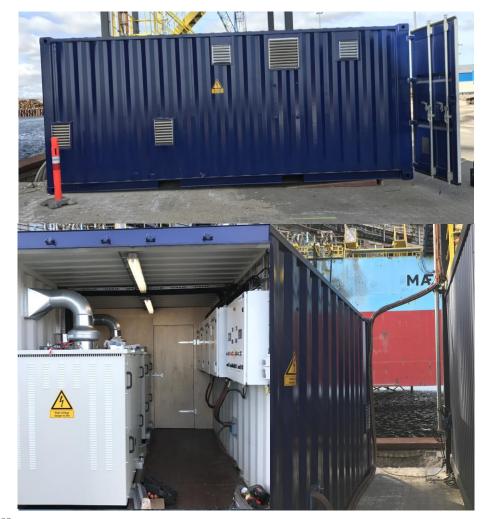
in air-cooled, liquid-cooled, and low harmonic variants

FAYARD is a family-owned repa yard at the Lindø Industrial Park Denmark FAYARD has been owned by the Andersen family ince 1916 and moved from Fredericia to Linda in 2010. AYARD has a workforce of 700 - 800, consisting of its ow staff as well as sub suppliers and contractors. Many of the supplier ave their own site offices nearby at Linde. Today, FAYARD is a modern repair

FAYARD 36

The VACON® NXC drive is available

yard with four large-scale dry canacity cranes and a 200 m. working berth. The shipyard performs repair, maintenance and upgrade of all types of maritime





# Innovative SHORE to SHIP POWER

- Green Energy solution at FAYARD
  FAYARD has 10 mobile shore connecting power supply systems 300A/690V, 500A/440V & 1500A/440V with Vacon AC drives to provide electricity from the national grid to the app 130 vessels and platforms, yearly in dock or alongside at FAYARD.
- The Shore to Ship solution can supply the required voltage and the required frequency.

#### The green solution has many advantages:

- Proven Technology has been in operation since 2009.
- Low exhaust emissions, great flexibility.
- Power, voltage and frequency,
- Lower costs of operation, noise and GHG-emissions.
- The Green Energy Shore Connections are incorporated in FAYARD's ISO14001:2015 certification.

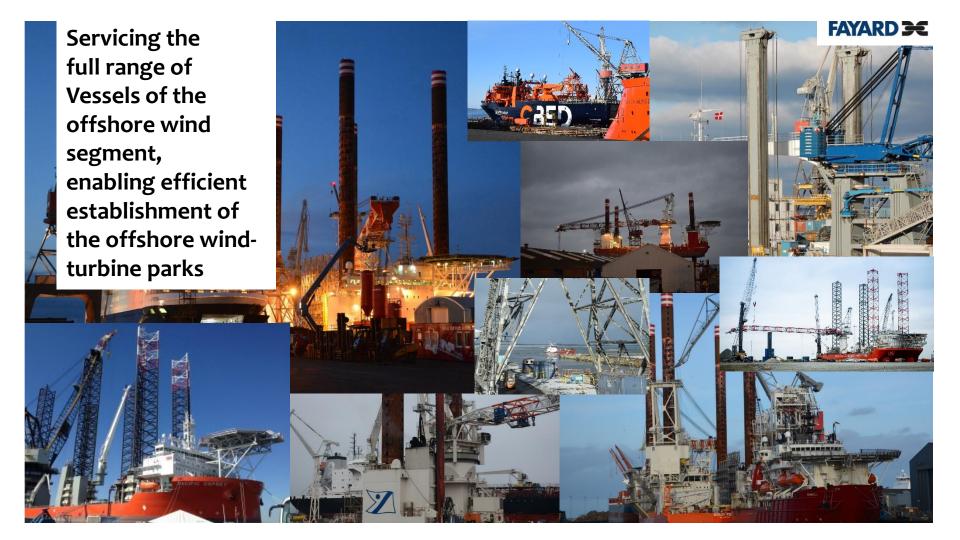


# AFFORDABLE AND CLEAN ENERGY



THE ESTABLIHING OF FUTURE FOSSILFREE POWER REQUIRES SIGNIFICANT MARITME INVOLMENT

QUALITY ON-TIME ALWAYS





## 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



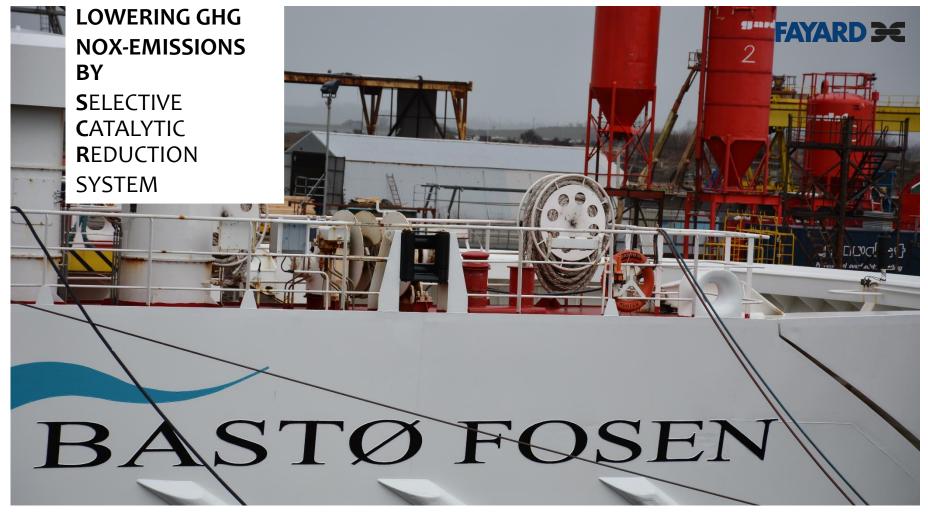
### Emission to Air reductions NEXT is NOx-Limitation

#NOx #SCR Catalysator #DPF Particle filters

**Selected Case Stories** 

QUALITY ON-TIME ALWAYS







# 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



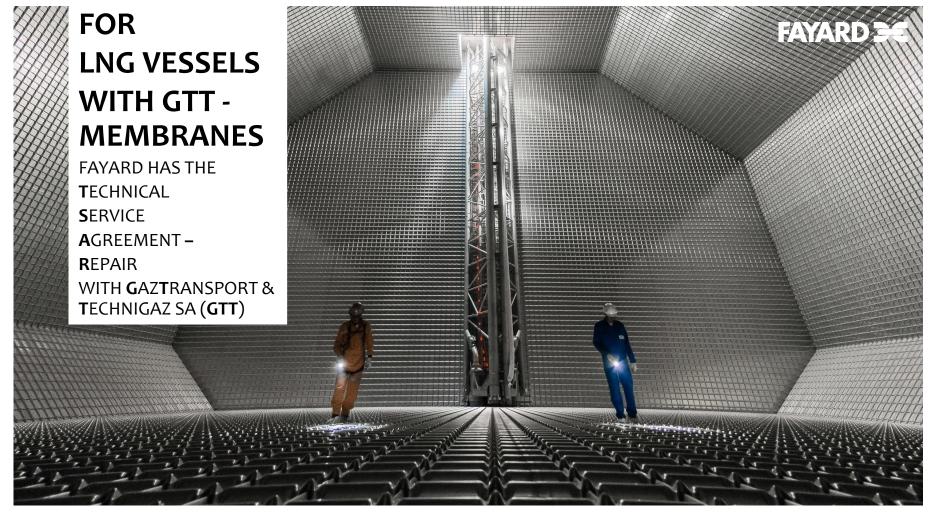
#### **FUTURE FUELS**

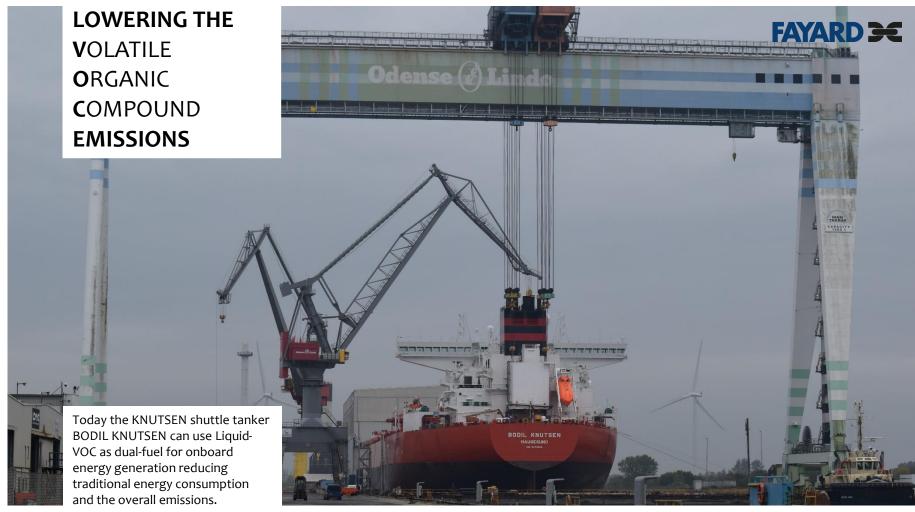
for reducing emission to air

**Selected Case Stories** 

QUALITY ON-TIME ALWAYS





































6 CLEAN WATER AND SANITATION





#### Improvements Implemented

- We are fully committed to conducting our activities in an environ-mentally responsible manner. In our attempt to run a yard that is as environmentally friendly as possible we have amongst others
- Dry Docks are environmentally Closed Loop systems
- Hull Cleaning by Water Jetting as standard
- Shore Power availability reduces vessel emissions
- Tank Washing Water Receive System (Slop)
- Vessels in Inerted condition allowed
- Lower VOC Emission to air than allowed quota
- Waste Management System in operation
- All Chemicals are stores in Secured areas
- Recycling of scrap materials availability
- LED-bulbs where applicable
- EU-approved Ship-recycling facilities

#### MANAGEMENT SYSTEM

Certified to the ISO 9001, 14001 & 45001 standards by Bureau Veritas



FAYARD's special focus on adapting to your requirements means that we are able to take on any roles that you would like us to.

We co-operate very efficiently with makers and owners in Energy Efficiency projects in order to make a clear split of the work in the project in advance, including the following scopes:

- Engineering
- Procurement
- Construction
- Installation
- Commissioning

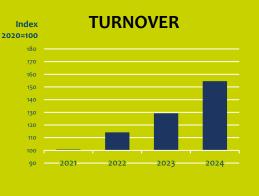
In doing so, we make sure that you will see your vessel handled effectively and that the project progress is fast, and your assets spends the least possible time in yard.

Naturally, quality, safety, and compliance are warranted by our various systems and work ethics.

FAYARD - Trusted to Perform



FAYARD 🗲



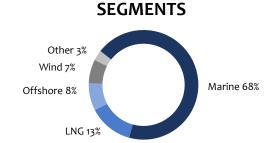
**VESSELS PER YEAR (avg.)** 

**2024 DOCK UTILIZATION** 



### THE NUMBERS

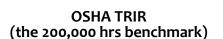




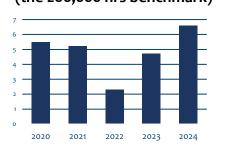
**DELIVERED ON-TIME** 

100%

**PART OF TURNOVER** FROM RETURNING CUSTOMERS



FAYARD 🗲





**DOCK AVAILABILITY** Meets requested service slot

#### **Quality - On time - Always**





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