Dual-fuel vessel an investment strategy, risks & viability

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Your link to the future of shipping.

Key Environmental Benefits of LNG as fuel

Sulphur and Particulates	Virtually contains less sulphur oxides (SOx) and particulate matter (PM), helping ships comply with global caps and Emission Control Areas (ECAs).
Nitrogen Oxides	Cuts nitrogen oxide (NOx) emissions by up to 80% to 95% relative to conventional marine fuels.
Greenhouse Gases	Reduces carbon dioxide (CO2) and greenhouse gas emissions by up to 23% on a lifecycle basis, depending on the engine technology used

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Operational & Strategic advantages

Transition pathway	Acts as a steppingstone towards zero-carbon shipping since dual-fuel engines can seamlessly transition to bio-LNG (liquefied biogas) or e-methane without equipment modifications
Established infrastructure	Supported by an expanding global bunkering network across hundreds of major international ports.
Regulatory technology	Future-proof vessel designs against tightening regional and international decarbonization regulations

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Operational & Strategic advantages

Proven Technology

Thousands of LNG engine installations worldwide.

Proven designs from Everlence and WinGD

Extensive operational experience in ferries, tankers, container ships, cruise vessels, and bulk carriers

Lower technical and operational risk than ammonia, methanol and hydrogen.

Familiarisation of crews.

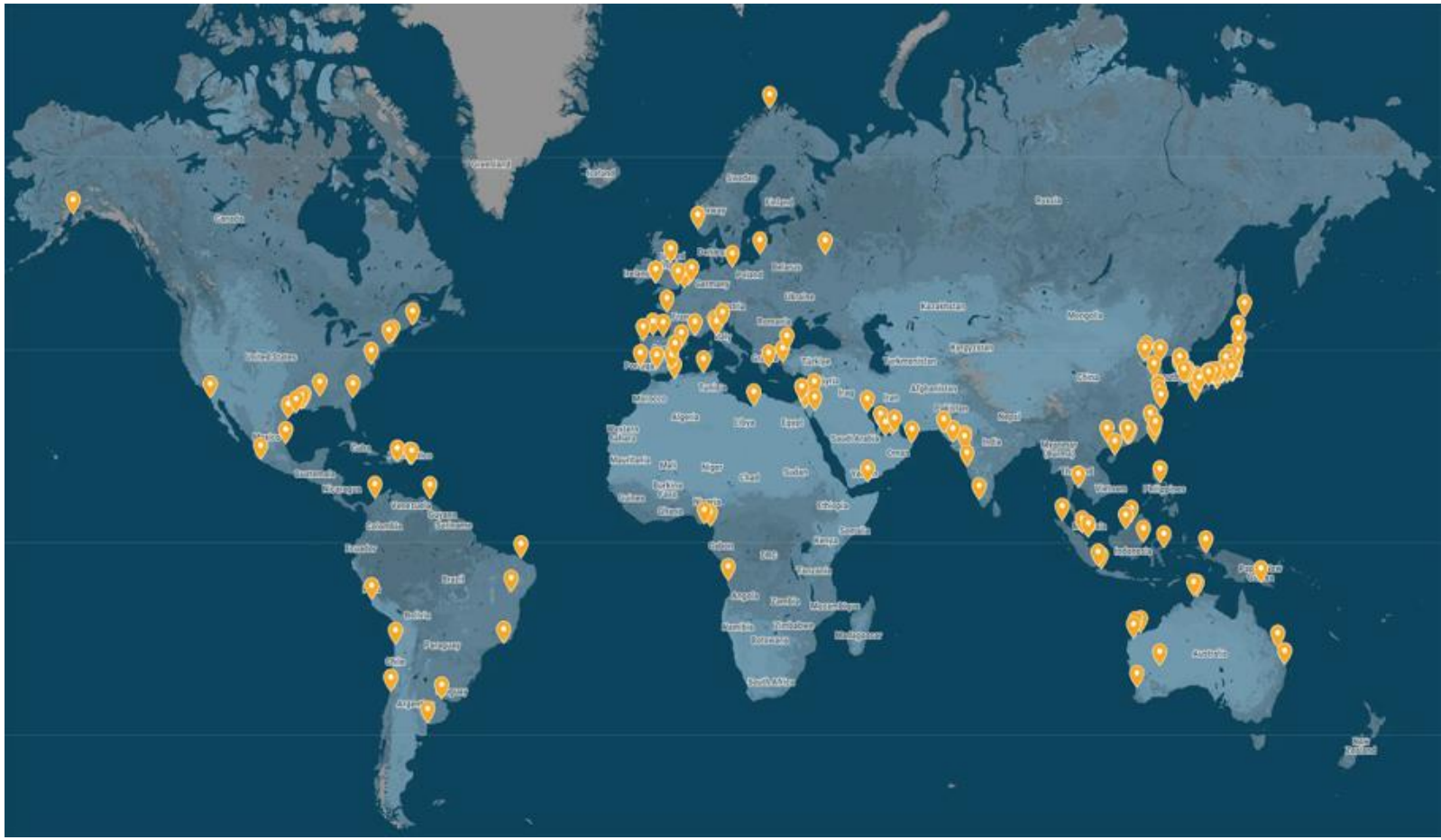
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LNG fuel availability worldwide.

222 ports
Worldwide

62 active
LNG bunkering vessels
with 38 on order

70 ports
Bio-LNG availability



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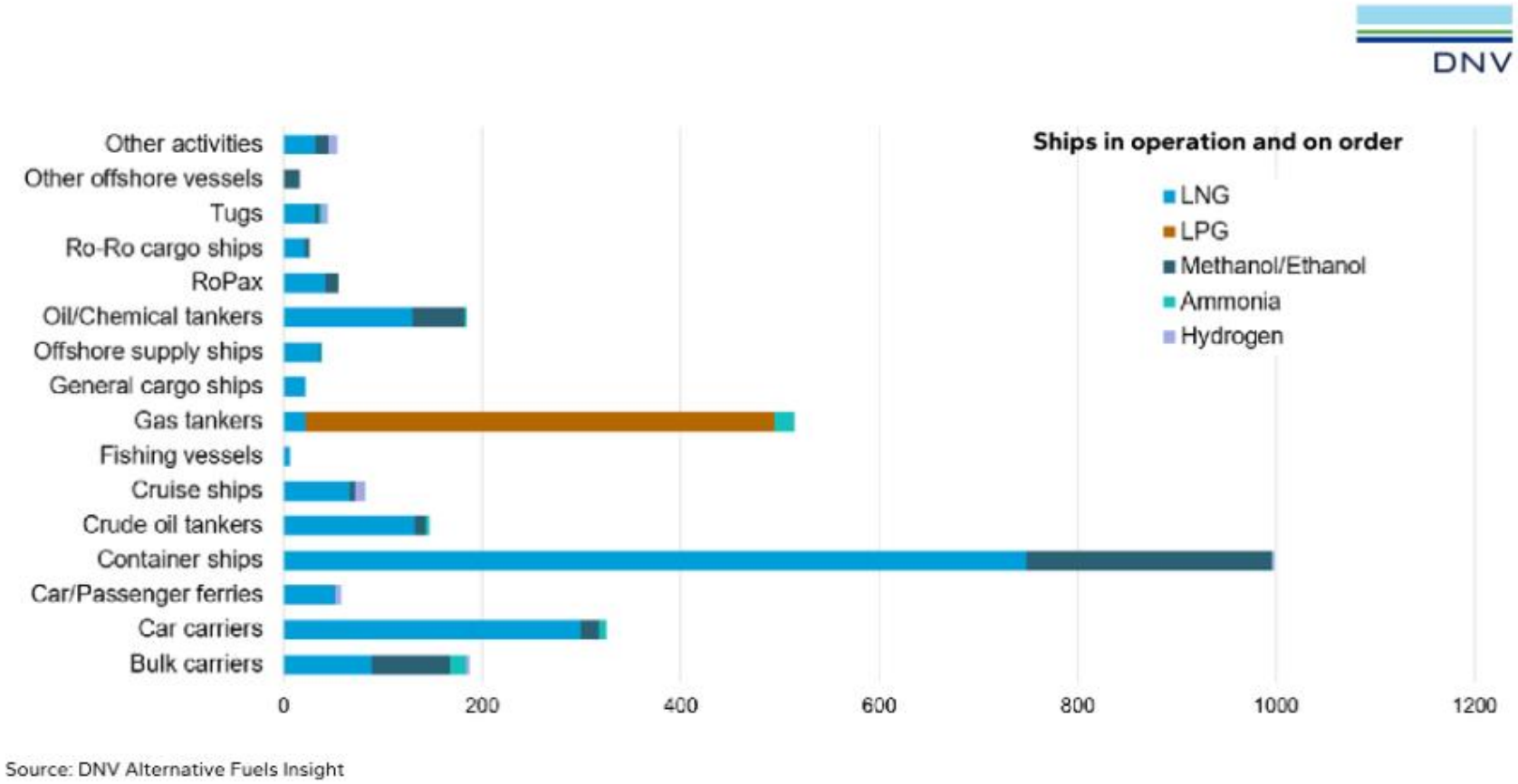
LNG dual-fuelled fleet

1352 vsls
D/F LNG-fuelled in total

503 vsls
In operation

849 vsls
On order

$200 bn
Surpassed, total investment



Source: DNV Alternative Fuels Insight

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Future trends in LNG marine fuel systems

Several industry trends are influencing LNG system development

- Larger LNG fuel tanks
- More efficient vaporisers, fuel pumps, N2 generator systems, etc.
- Advanced automation systems
- Improved LNG bunkering technologies
- Better insulation materials
- Digital monitoring systems

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LNG FGSS system

- High & Low LNG fuel pumps
- Nitrogen generator

Selecting FGSS

The selection of the subcomponents must be based on:

1. Safety
2. Reliability
3. Efficiency
4. Spare parts availability
5. Spare parts lead times
6. Technical support & Service network
8. Cost of operation

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Improvements on the main components of LNG FGSS

The design and the operation of FGSS are improved. Major components of an FGSS system can vary according to owners' preferences, and the selection of low-pressure or high-pressure dual-fuel main engines.

- Low- & High-pressure fuel cryogenic pumps.
- Closed-loop helium condensers/piston compressors for the boil-off gas in fuel tanks.
- Nitrogen Generators for fuel tanks purging.

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Low-pressure LNG fuel pump

- Low-pressure submerged pumps no wear-prone gaskets or seals, ensuring exceptional reliability and long service life.
- Always submerged in cryogenic liquid, enabling immediate start-up and eliminating cool-down downtime.
- Easy dry-dock removal, requiring minimal space on the tank dome.
- Zero-pressure-drop suction filter protects bearings and prevents LNG contamination downstream.
- High-capacity basket filter with up to 40× larger flow area, significantly reducing cavitation risk.
- Fully controlled supply chain, ensuring long-term spare parts availability and technical support.





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High-pressure LNG fuel pump

- High-pressure reciprocating pumps (simplex, duplex, or triplex) with discharge pressures up to 420 bar.
- Class-approved skid-mounted packages with integrated sensors, instruments, and valves for safe, reliable operation.
- Configurations available as 2×100%, 3×50%, or mirrored 2×100% (with or without control valves/vaporizer).
- Low-NPSP Cold End design (down to 2 bar), reducing cavitation risk and delivering significant OPEX savings.



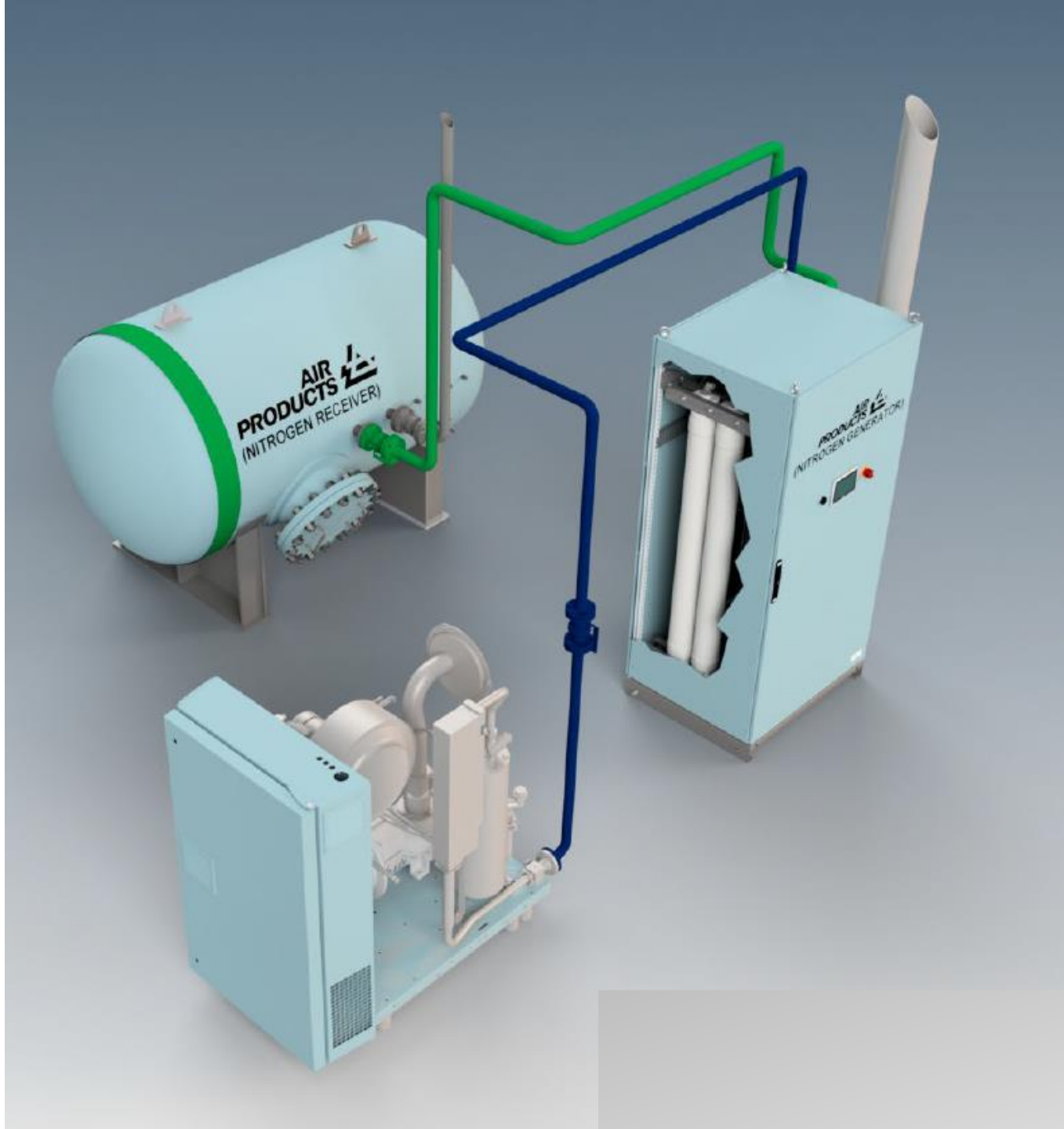
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Nitrogen system for D/F

Single or double configuration
Delivery pressure up to 13,5 bar at design capacity

They offer Rapid Startup and Purity Adjustments
They can deliver on-spec nitrogen almost instantly, ideal for purging

This rapid response is critical for sudden engine mode changeovers or emergency shutdowns



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Nitrogen system for D/F

Small-sized nitrogen generator system to meet the available
space requirements of retrofit projects.



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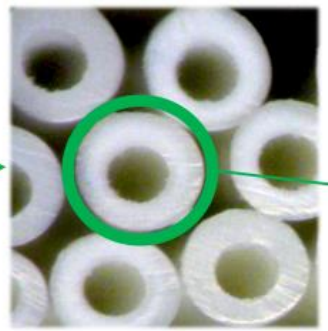
PRISM® Membrane Separators

How it Works

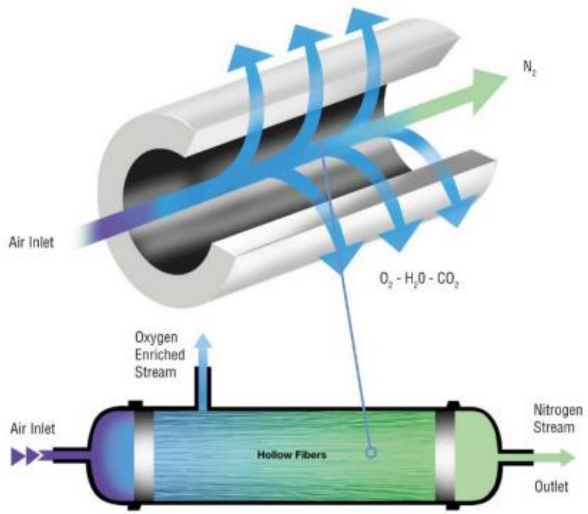
- Every PRISM® Membrane Separator is filled with thousands of hollow fibers that act as a molecular filter
- Membranes are used to separate gas mixtures based on selective permeation
- When compressed gas mixtures enter the separator, fast gases (such as oxygen) travel easily through the filter and exit the side port. Slow gases (such as nitrogen) can't permeate the fiber wall and travel the length of the fiber, exiting through the end of the separator

Membrane separators can be arranged in series or parallel depending on application requirements





Hundreds of **hollow polymer fibers** make a separator



Gas mixtures are separated in the fibers based on the principle of **permeation**



Closing remarks

LNG is playing a key role in shipping's energy transition, increasing the need for reliable cryogenic technologies and specialized technical support.

Oceanking supports Greek shipping companies with advanced cryogenic solutions, combining technical expertise, operational know-how, and close collaboration with shipowners and operators.

By listening to customer needs and leveraging operational feedback, Oceanking delivers practical solutions that enhance safety, reliability, and efficiency throughout the vessel lifecycle.

Our commitment extends beyond equipment supply to lifecycle support, through concrete initiatives, such as:

Collaborating with cryogenic vendors to deliver advanced technical guidance and operational troubleshooting support.

As LNG adoption grows, Oceanking remains a trusted partner to Greek shipping, delivering not only cryogenic solutions, but also the technical support and service infrastructure required for safe, reliable, and efficient vessel operations.

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Our partners for cryogenic applications

Dong Sung FINETEC

VANZETTI CRYOGENIC TECHNOLOGY

MannTek LNG Solutions

AIR PRODUCTS

CPR CRYO PUMP REPAIRS LTD

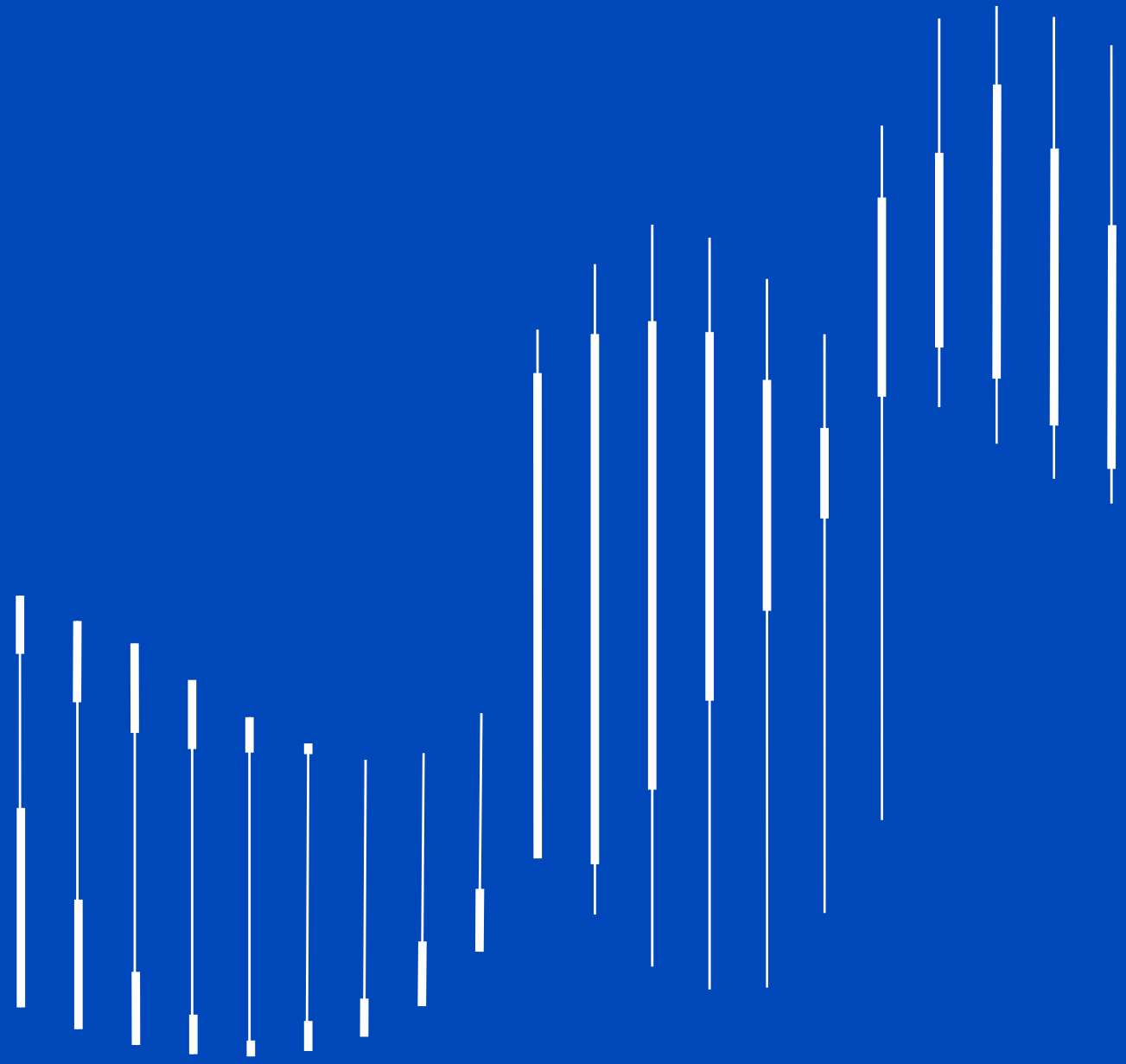
TB Global Technologies Ltd.

Atlas Copco Gas and Process

YOKOGAWA

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Thank you!



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