



# Ship Smarter with LPG

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# Ship Smarter with LPG as Marine Fuel

Makes sense from regulatory, environmental, operational and economic perspectives



## Changing, stricter regulations

- Full compliance with IMO 2020
- Improves performance related to EEXI, CII and enhanced SEEMP; helps with MARPOL Annex 1 compliance
- A step forward in complying with IMO 2050

## Transition fuel with lowest climate impact

- Lowest climate impact from well-to-wake life (WTW) and tank-to-wake (TTW) LCA of a drop of fuel
- LPG provides -17% in CO<sub>2</sub> emissions vs MGO; reduce emissions of SO<sub>x</sub> (~97%), PM (~90%) and NO<sub>x</sub> (~20%)
- No methane slip
- Retrofitting vessels for maximum impact

## Operational benefits boost bottom-line

- Savings from reduced fuel consumption
- Buffer from fuel price sensitivity
- More efficient engines are cheaper to maintain
- Reduce turnaround time because vessel refuel as it loads

# Liquefied Gas Injection (Propane) technology

Pioneering technology, now tested at scale with >10,000 hours in operation and counting



## A step towards zero-carbon propulsion

- Necessary and complementary step in the development of technology needed for zero-carbon propulsion
- LPG is drawn into fuel gas supply system and piped to engine
- A small amount of compliant pilot fuel such as VLSFO or MGO is injected into the engine as the piston nears the top
- It sparks under pressure, and LPG burns cleanly to create propulsive force

# Operational learnings

From simultaneous retrofitting of 2-3 vessels to STS of LPG bunkers at sea



## 10 retrofitting done, 5 more to go

- No major surprises during retrofitting process, including for world's first LPG-powered VLGC, BW Gemini
- Experienced, dedicated site team is critical to project success
- Importance of filters to manage organic materials in LPG
- STS of LPG bunker an innovative move, allowed site team better control over project timelines
- Had to manage quality concerns from main and sub-suppliers, but overall good experience
- Special thanks to our many partners for their support in this pioneering project

# THANK YOU

