

# SEA-LNG

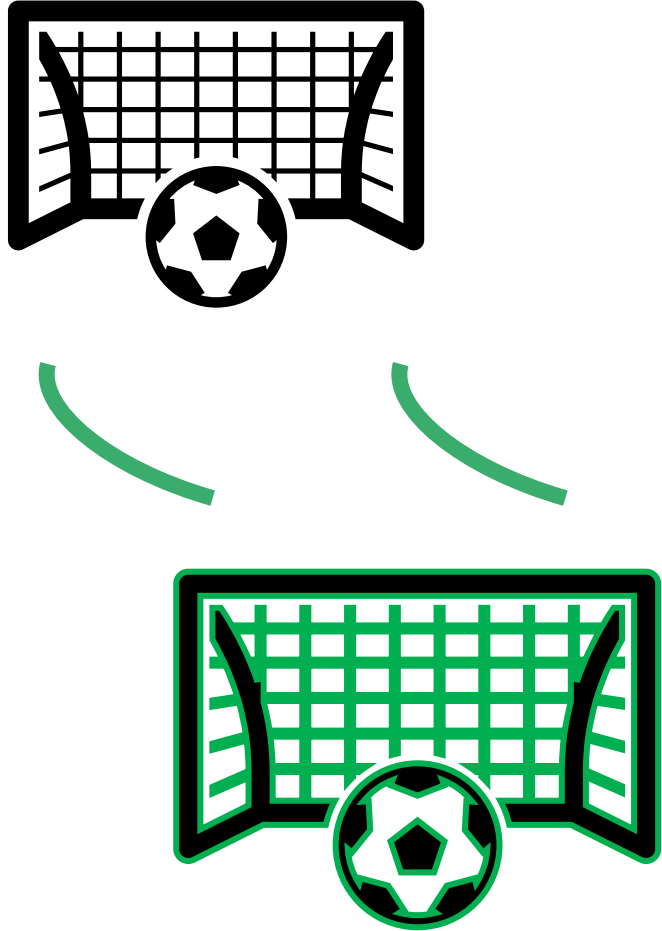
## IMO Technical Seminar on Methane-Based Fuels

*12<sup>th</sup> May 2026*



# Why LNG?

Focus shift from air pollution to GHG emissions



**From 2005** - Focus IMO air pollution regulations

- LNG cuts air pollution
  - 99% less SOx emissions
  - Up to 95% less NOx emissions
  - Reduced particulate matter and black carbon

**Today** – Focussing on GHG emissions (*but air pollution still matters*)

- Well-to-wake greenhouse gas emissions
- LNG transitioning to bio and synthetic

# LNG as a Marine Fuel

Its evolution as a practical and realistic option

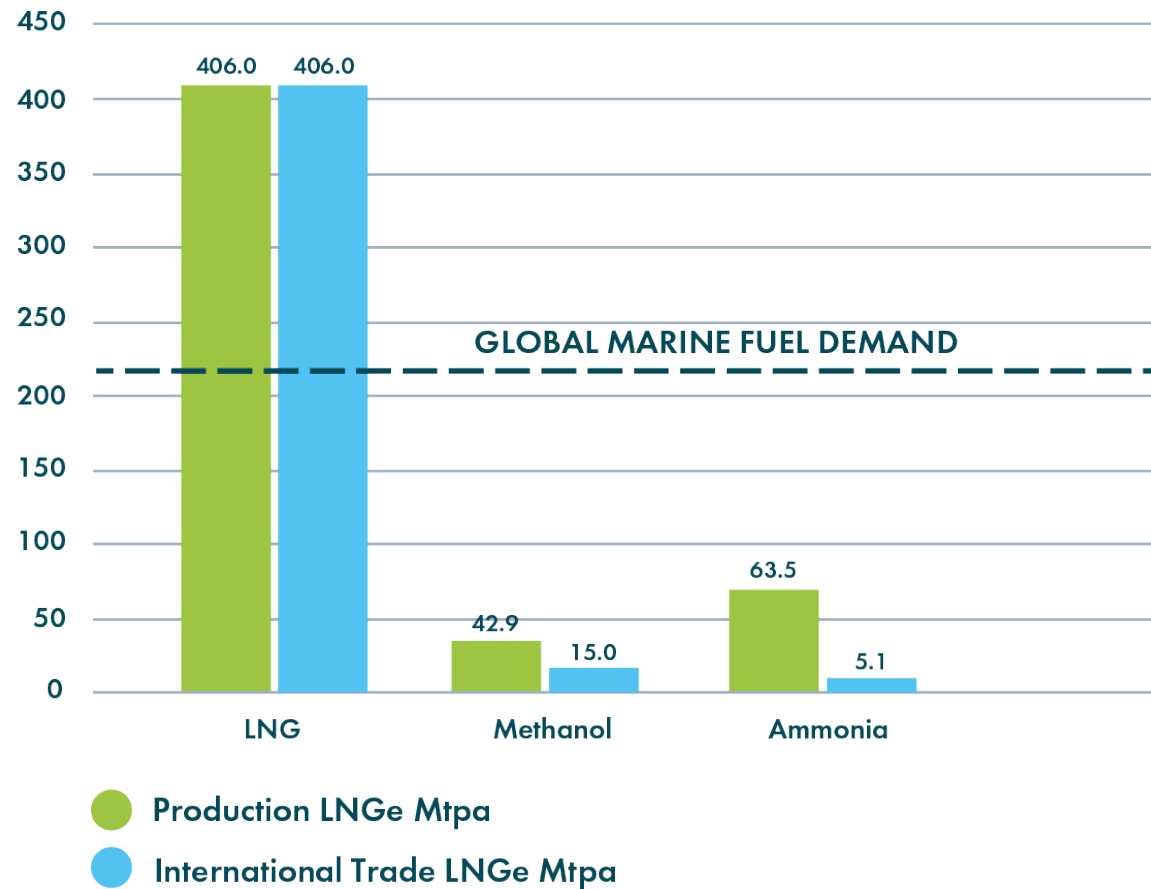
- LNG already exists at scale
- Collaboration solved chicken vs egg market situation
- LNG is a fuel on a journey, a fuel in transition



# Large International Commodity Market

LNG has been safely shipped for 60+ years

SIZE OF CURRENT FUEL MARKETS (Mtpa LNGe)

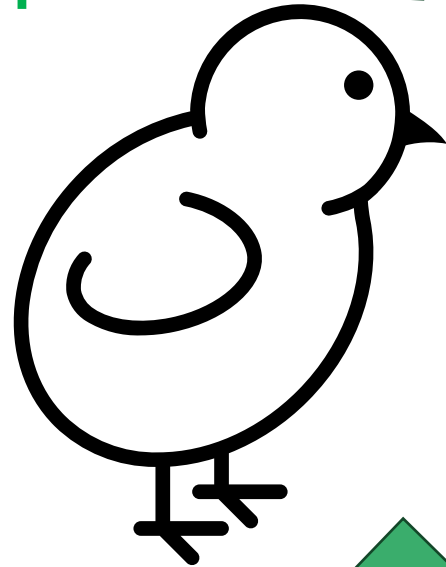


- Existing international trade in LNG is larger than shipping
- Shipping market provided an additional customer for existing producers
- Bunkering utilises global bulk distribution infrastructure and operating procedures

# Chicken or Egg

Industry collaboration solved the problem

**LNG-Fuelled  
Ships**



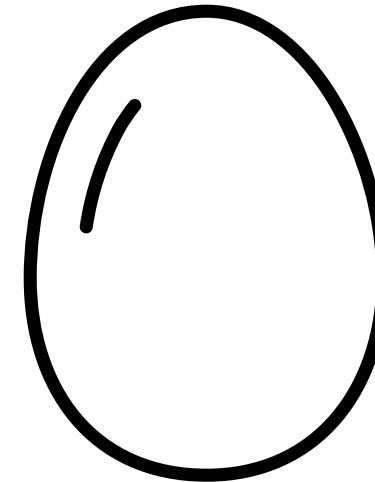
- High CAPEX
- Long asset life
- Fuel supply certainty before ordering

No Bunkering,  
No Ships

**SEA-LNG**

No Ships,  
No Bunkering

**LNG  
Bunkering  
Infrastructure**



- High CAPEX
- Long term investments
- Guaranteed offtake agreements before investing in supply

# Requirement to Overcome the Last Mile

3 key options that allow a ramping up of activity and costs



Image: Shell



Image: Shell

# Scaling in Practice

Two decades of progress reduced operational and regulatory uncertainty for LNG bunker vessels and ports

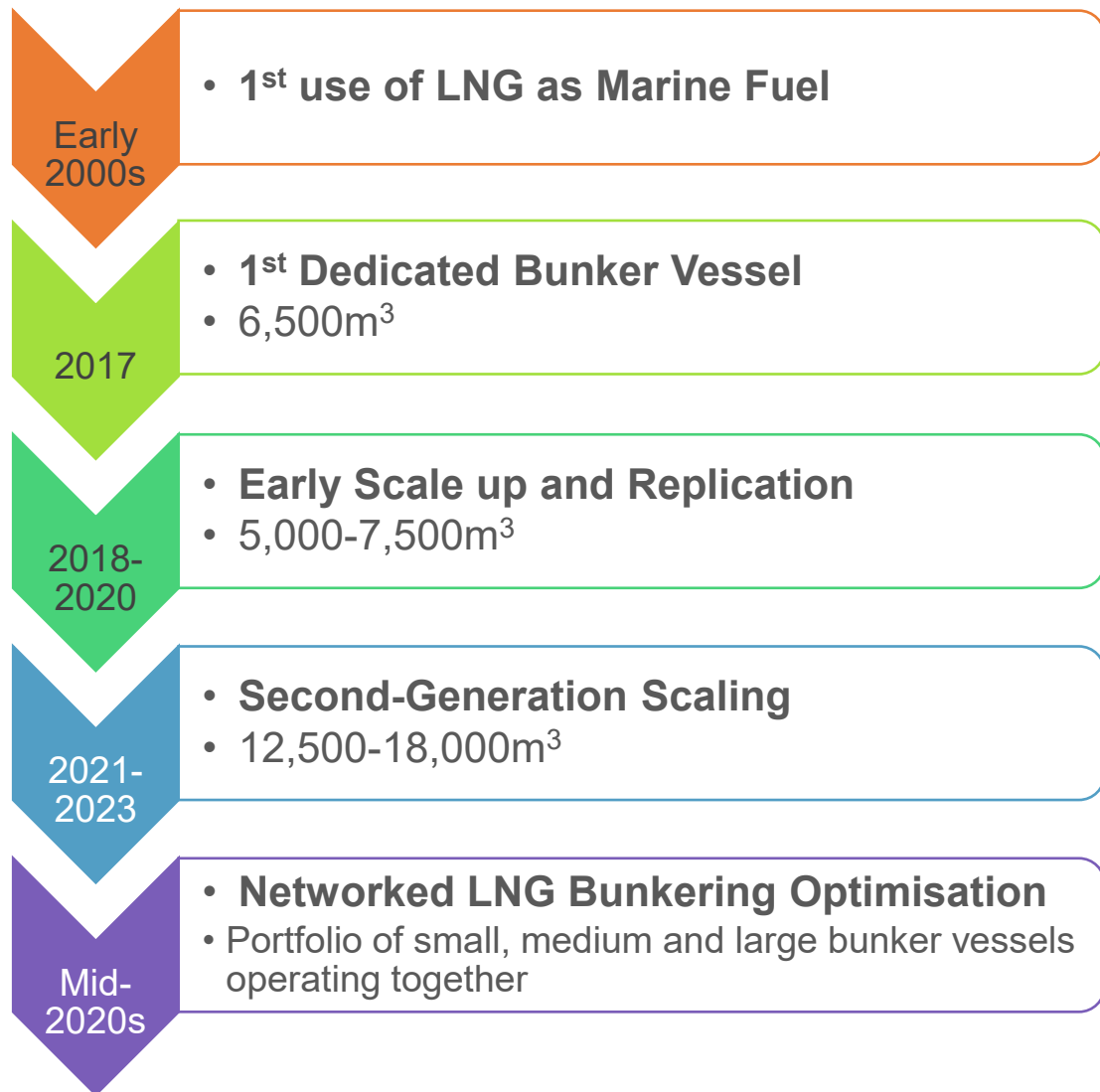


Image: Shell

# LNG Bunkering: Built on Certified Safety Frameworks

Safety maturity; built layer by layer - from pilots to governed systems

## Early Phase (2000s)

**Project-specific operations**

- Case-by-case approvals

## Controlled Pilots (2010–2015)

**Risk-managed demonstrations**

- First bunkering trials

## Standardisation (2015–2020)

**Procedures and equipment codified**

- Emergence of ISO guidelines (e.g. ISO 18683, ISO 20519)

## Industrialisation (2020–mid 2020s)

**Repeatable and scalable operations**

- Port authority frameworks established

## Mature System (Today)

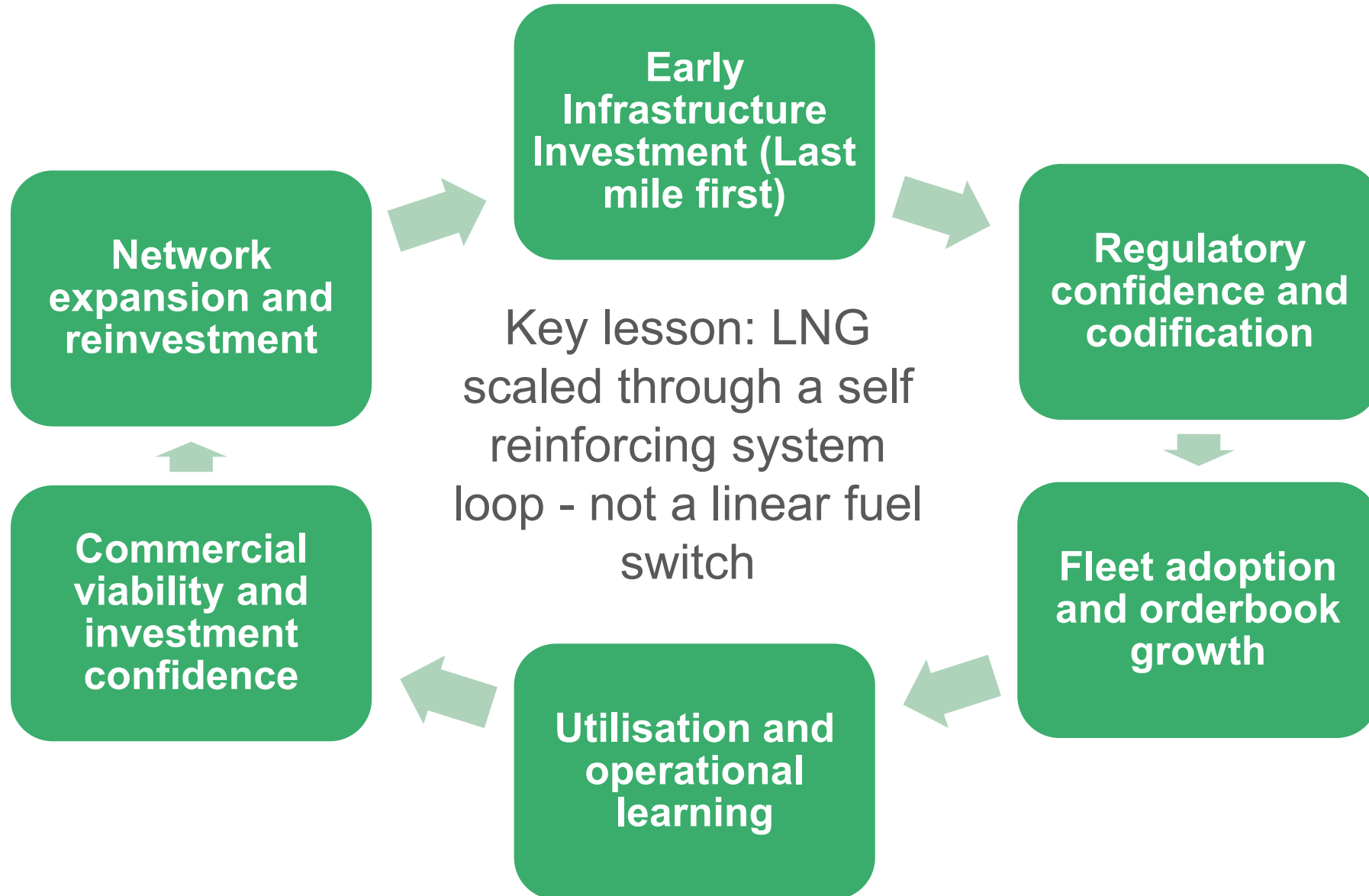
**Governed, auditable safety system**

- Integrated IMO + ISO + Class framework

Today's LNG bunkering operations are conducted under internationally recognised standards, governed procedures, and certified systems across the full value chain.

# LNG Bunkering: Case Study for Collaboration

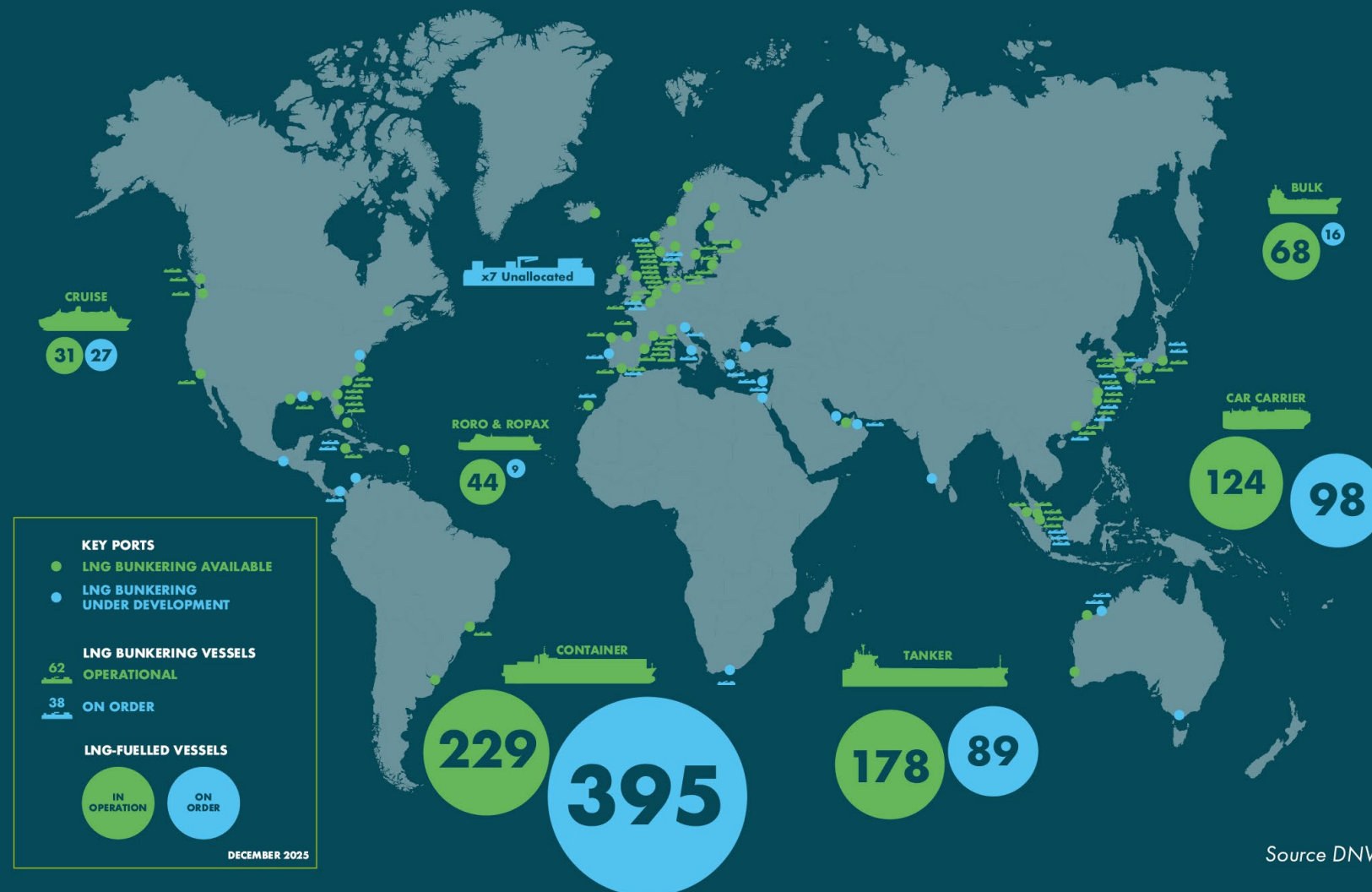
Infrastructure, regulation and fleet adoption progressed collectively



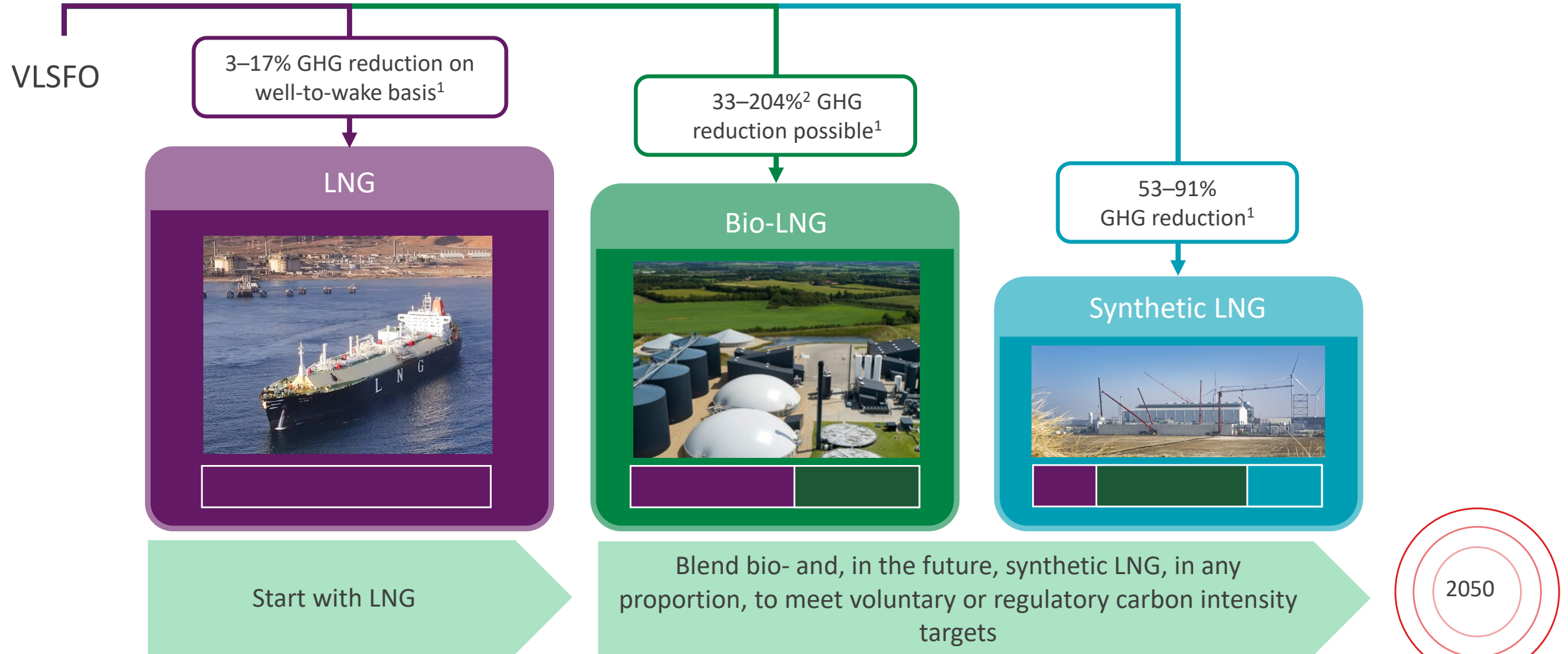
# Status of LNG as a Marine Fuel in 2026

Rapidly growing numbers of LNG-fuelled ships & bunkering volumes

## WORLDWIDE GROWTH IN LNG USE AND INFRASTRUCTURE



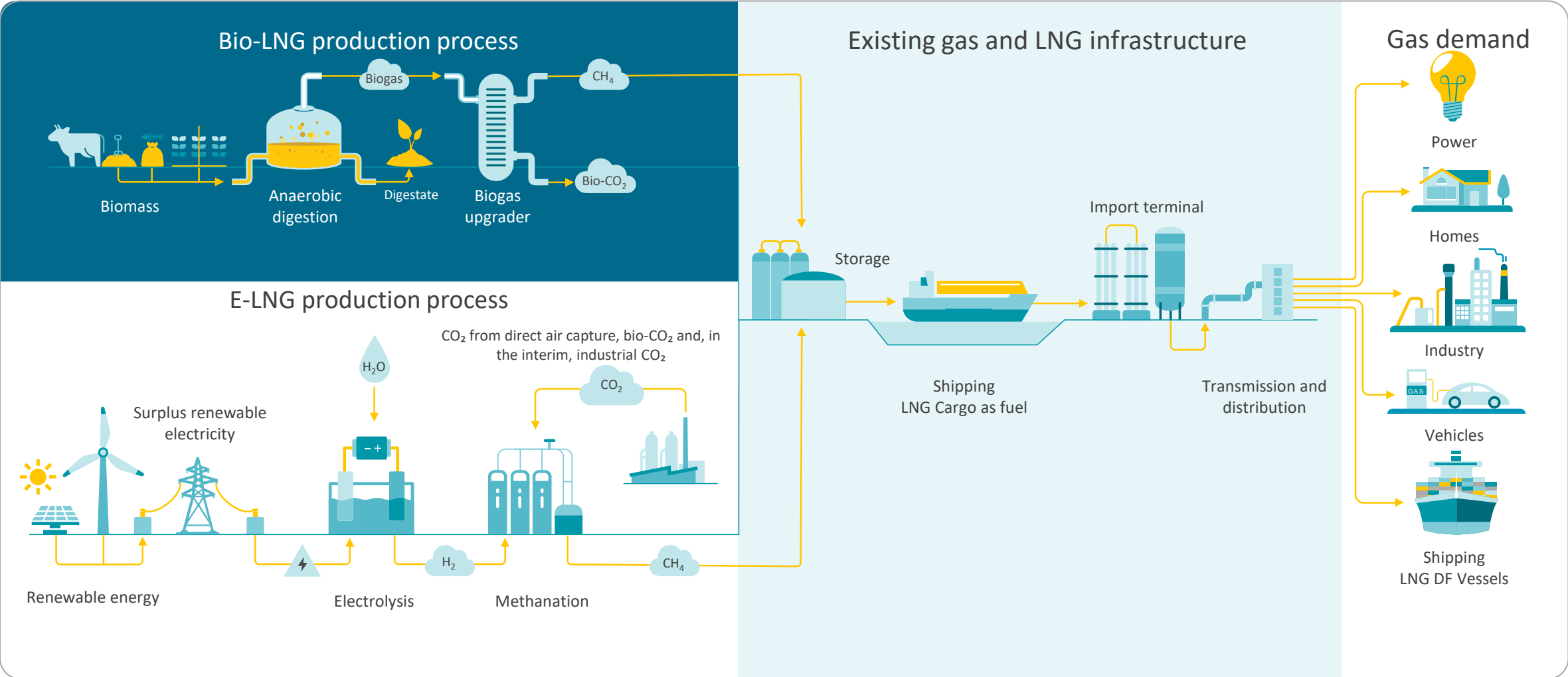
# The Methane Decarbonisation Pathway



GHG reduction is calculated using fuel default values from:  
 FEUM: REGULATION (EU) 2023/1805  
 RED: DIRECTIVE (EU) 2018/2001  
 JEC WTW Study Version 5 2020 - CBM Workbook from Appendix 1

1. Compared to Very Low Sulphur Fuel Oil (VLSFO), the differences in greenhouse gas (GHG) reductions on a well-to-wake basis for each fuel are due to variations in the materials used, how the fuel is made, and how emissions are measured.  
 2. Bio-LNG can achieve one of the lowest or even negative CO<sub>2</sub>e emissions intensity values on a life cycle basis when manure is used as a feedstock, when considering all emissions associated with the production and use of the fuel, including avoided emissions, recognized in EU REDII and US CARB LCFS methodologies.

# Gas & LNG Infrastructure Ready for Bio and e-LNG



# What LNG has Taught us – for All Future Fuels

Pathway for all deep-sea alternatives is fossil->bio->synthetic

Early risk takers reduce system risk later

Fleet and fuel must scale together

The last mile is decisive

Regulation is a key enabler

Bio and synthetic for net zero

# SEA-LNG

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Questions?

