Dual Fuel Green-Ammonia Tankers

PETCO Strategy for Zero-Emission by 2030

The PETRONAS Group adopts zero tolerance against all forms of bribery and corruption. All employees are to abide by the PETRONAS Code of Conduct and Business Ethics (CoBE) & Anti-Bribery and Corruption (ABC) Manual, guided by our Shared Values and Statement of Purpose

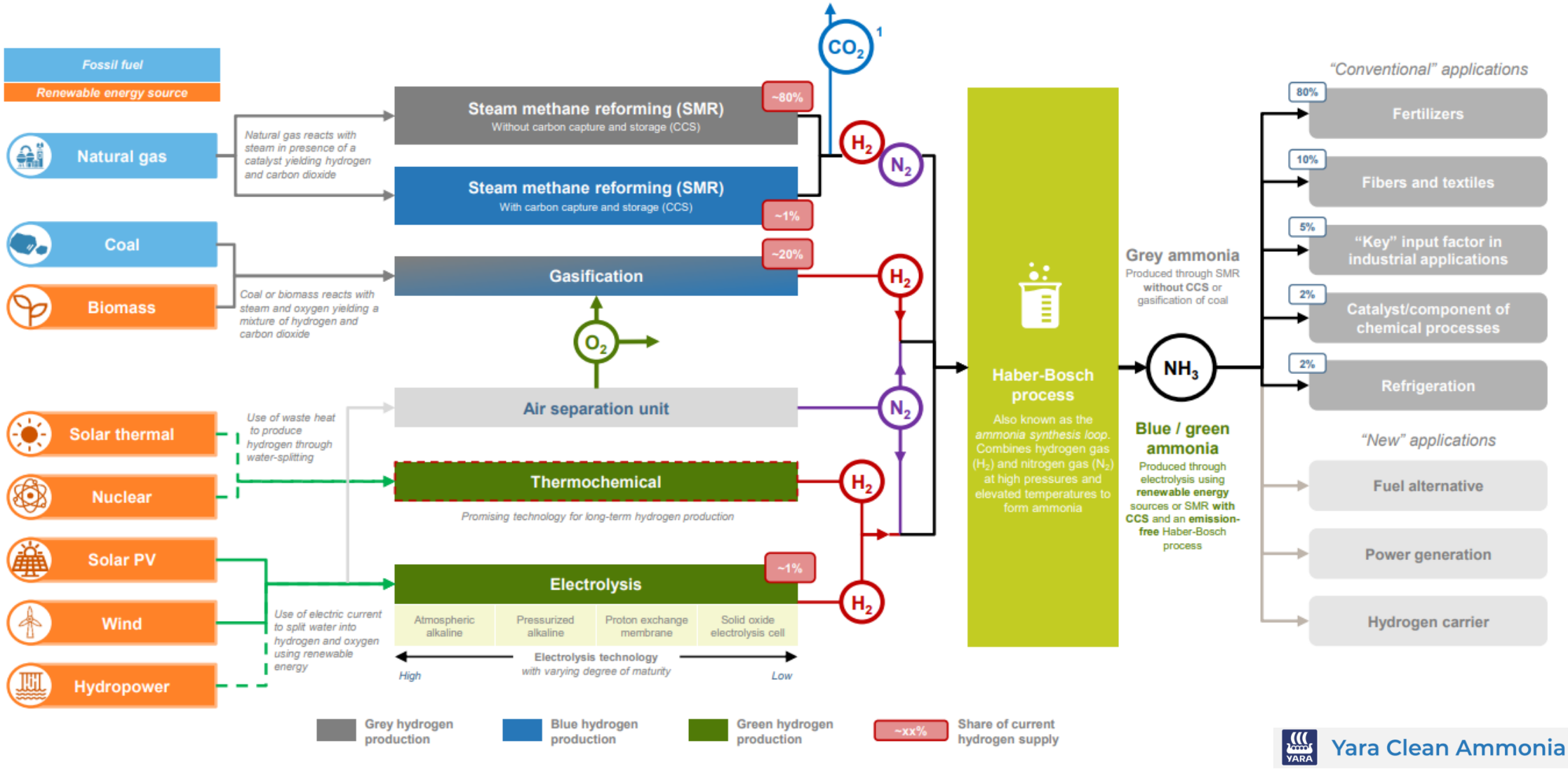
Initiative Background

1. The Castor Initiative began in Jan 2020 with the goal to meet IMO 2050 ambitions on halving greenhouse gas (GHG) emissions by:
    - Encouraging the use of green-ammonia as propulsion fuel
    - Development of strategic bunkering points & crew training syllabus
    - Looking into safety regulations, operational readiness, engine & vessel design

2. MISC via AET is developing Project Aurora, an extended project to The Castor Initiative, which is a proposed collaboration between AET & PTLCL to decarbonize for the future, in the case of Green Ammonia Dual Fuel tankers.

3. A 3-years NDA has been signed by AET & PTLCL, which enables both parties to explore the feasibility of green-ammonia as an alternative main propulsion fuel for driving de-carbonization in maritime industry.

The ammonia production process in detail



Yara Clean Ammonia

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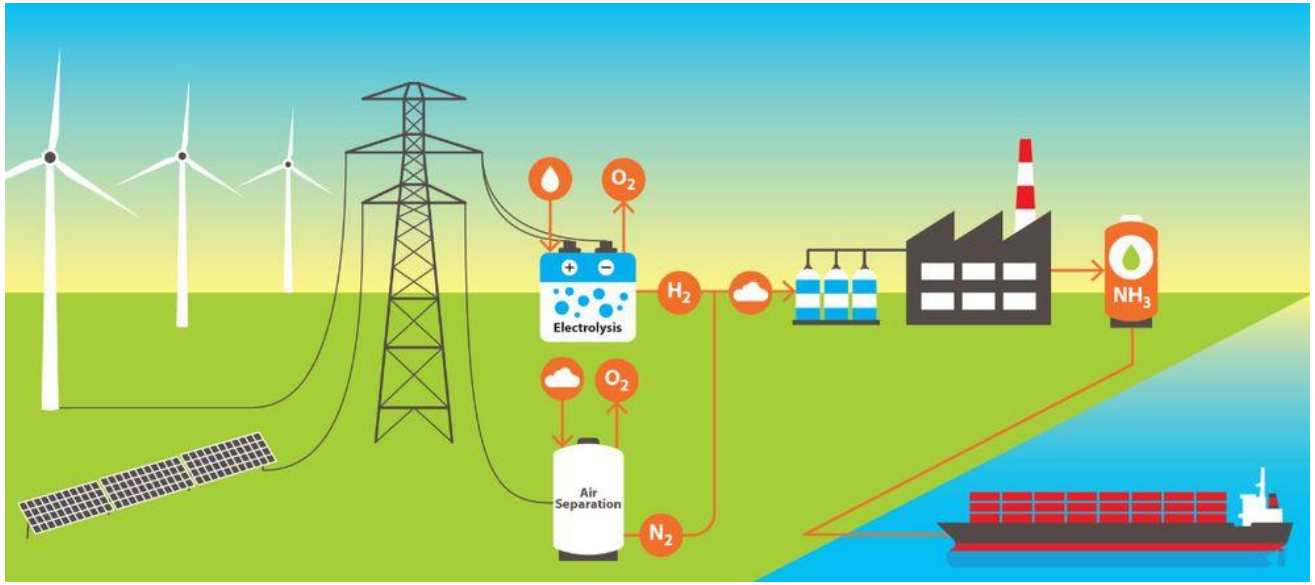
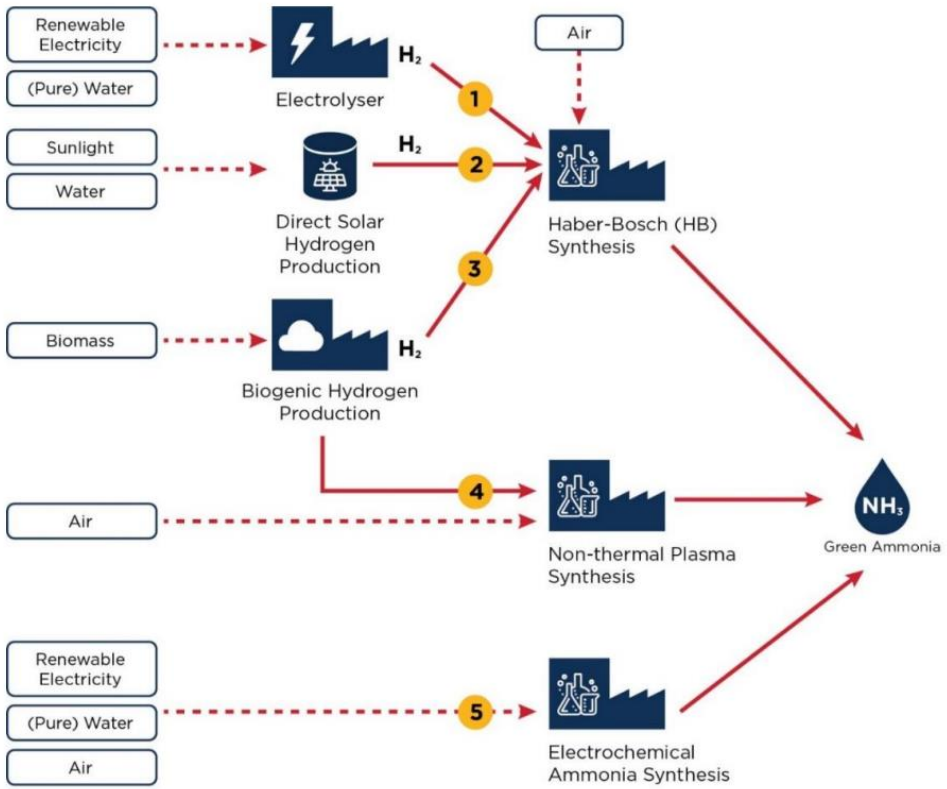
Green-Ammonia Production





GHG Emissions and Air pollutants from Ammonia vs Fossil Marine Fuels

Pollutant	HFO, MGO	LNG	Ammonia (combusted in engines)
SO_2 and metals	Present	Not present	Not present
Carbon monoxide and hydrocarbons	Present	Present or increased	Not present
VOCs and PAHs	Present	Reduced	Not present
NO_x **	Needs SCR for Emission Control Area	Otto engines meet Emission Control Area without SCR	Needs SCR for Emission Control Area
Direct particulate matter	Present	Reduced	Reduced
Ammonia (NH_3) ***	Low	Not present	Unknown
N_2O	Present	Present	Present or increased****
CH_4	Low	Present at Otto engines	Not present
CO_2*****	Present	Present	Not present

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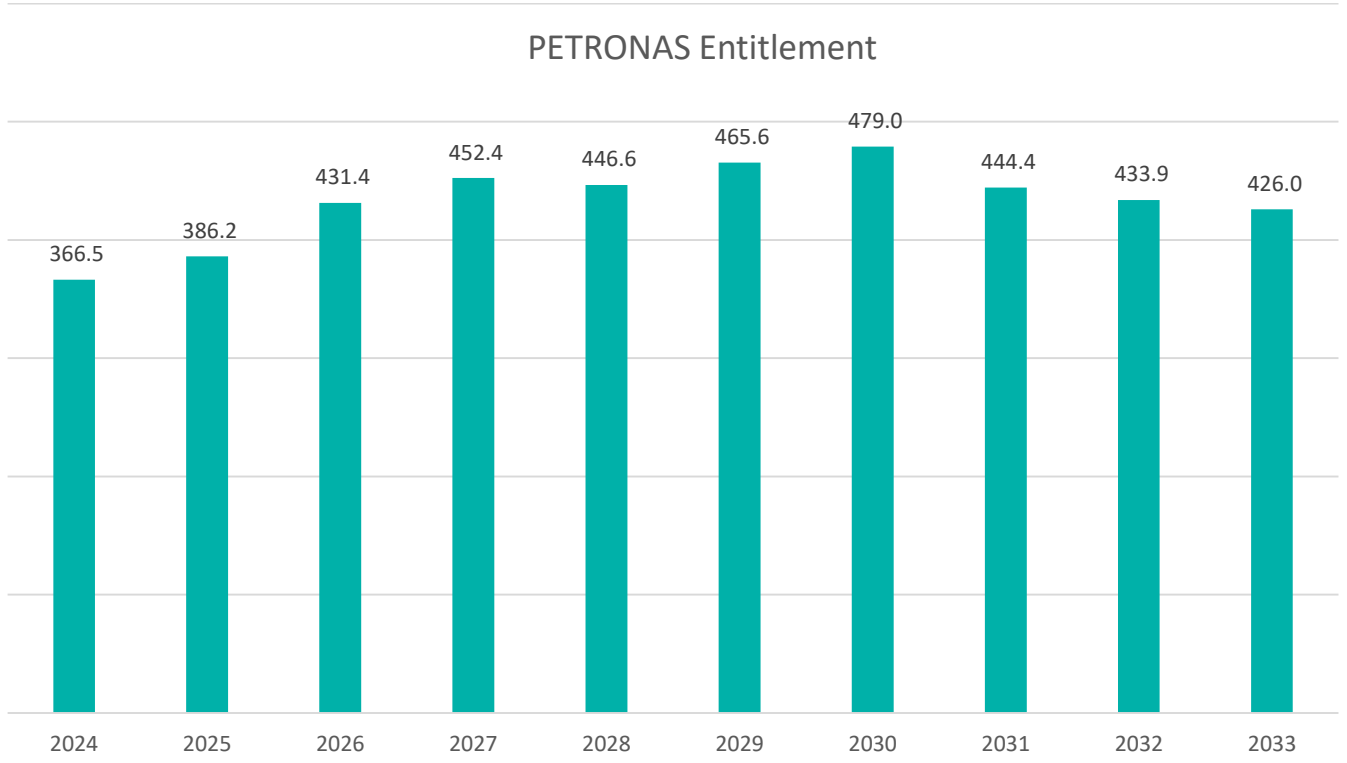
MCO Long Term Production (2024 - 2033)

Minimum two (2) Aframax is required to serve MRC with potential freight optimization opportunities within the region



Source: PETCO Crude Department

Basis and Assumption:

- Malaysia Crude Long Term profile (2024 – 2033) is based on MPM Production Conversation 2023, originated from Unconstrained Portfolio GPV 2023 (inclusive of Notional and Unsanctioned project) dated 30th Jan 2023
- Production Entitlement is forecasted based on Portfolio GPV 2023 Economic runs
- Numbers are inclusive of crude and condensate in kb/d

Efforts

Engaging Crude trading department to get MCO production outlook for the next 10 years to validate the requirement of vessel .

- Result shows that the requirement for Aframax vessels is still valid with minimum of 2 or 3 vessels in the future

Collaboration with AET to provide long term contract

Engaging several parties for further understanding in terms of production and supply of ammonia

Challenges

The usage of ammonia as a bunker fuel is still at development phase

Bunkering and supply of ammonia - there are no established bunkering facilities or infrastructure to supply ammonia as a bunker fuel. Limited supply of green ammonia into shipping industry – Currently there is only one established producer and supplier for green-ammonia; Yara

Safety - Toxicity of ammonia

Economics - Ammonia is more costly compared to current bunker fuels though it is expected to drop with the production of green-ammonia

Results and Achievements

Results

- On 27th of February, MOU signed between AET and PETCO Trading Labuan Company Ltd (PTLCL) to explore potential collaboration to deploy a future zero-emission Aframax.

Achievements

- Positive step to advance PETRONAS aspiration in net-zero carbon emission and in support of IMO’s greenhouse gas intensity reduction agenda.

Initiative Operation Status and Completion Date

Status:

- Main Engine Readiness – Testing expected to be on Q2 of 2024
- Safety Features for vessel design have been validated by Class

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