

The Green and Blue Ammonia Value Chain

Hoe Wai Cheong

President – Gas, Fuels, & Chemicals
Executive Sponsor -- Decarbonization



Black & Veatch's Capabilities

- Renewable Power
- Hydrogen
- Ammonia
- Terminals
- LNG, including Bunkering
- Natural Gas Processing
- Carbon Capture

ENR 2021 Rankings

Top Design Firms

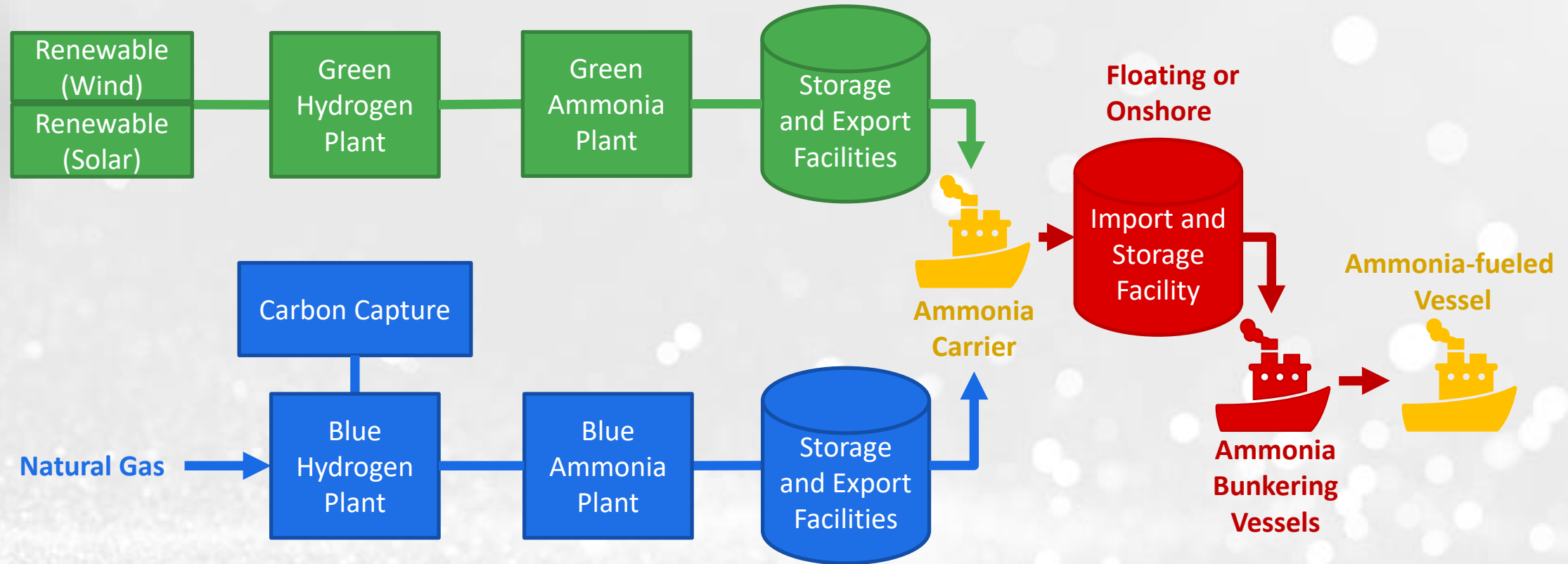
- #1 Solar Power
- #2 Power
- #2 Fossil Fuel
- #3 Offshore and Underwater Facilities
- #7 Water Services
- #9 Refineries and Petrochemical Plants
- #11 Top 50 Designer in International Markets
- #13 Top 500 Design Firms
- #17 Petroleum

Top Contractors

- #8 Power
- #15 Top 50 Contractors Working Abroad
- #20 Petroleum

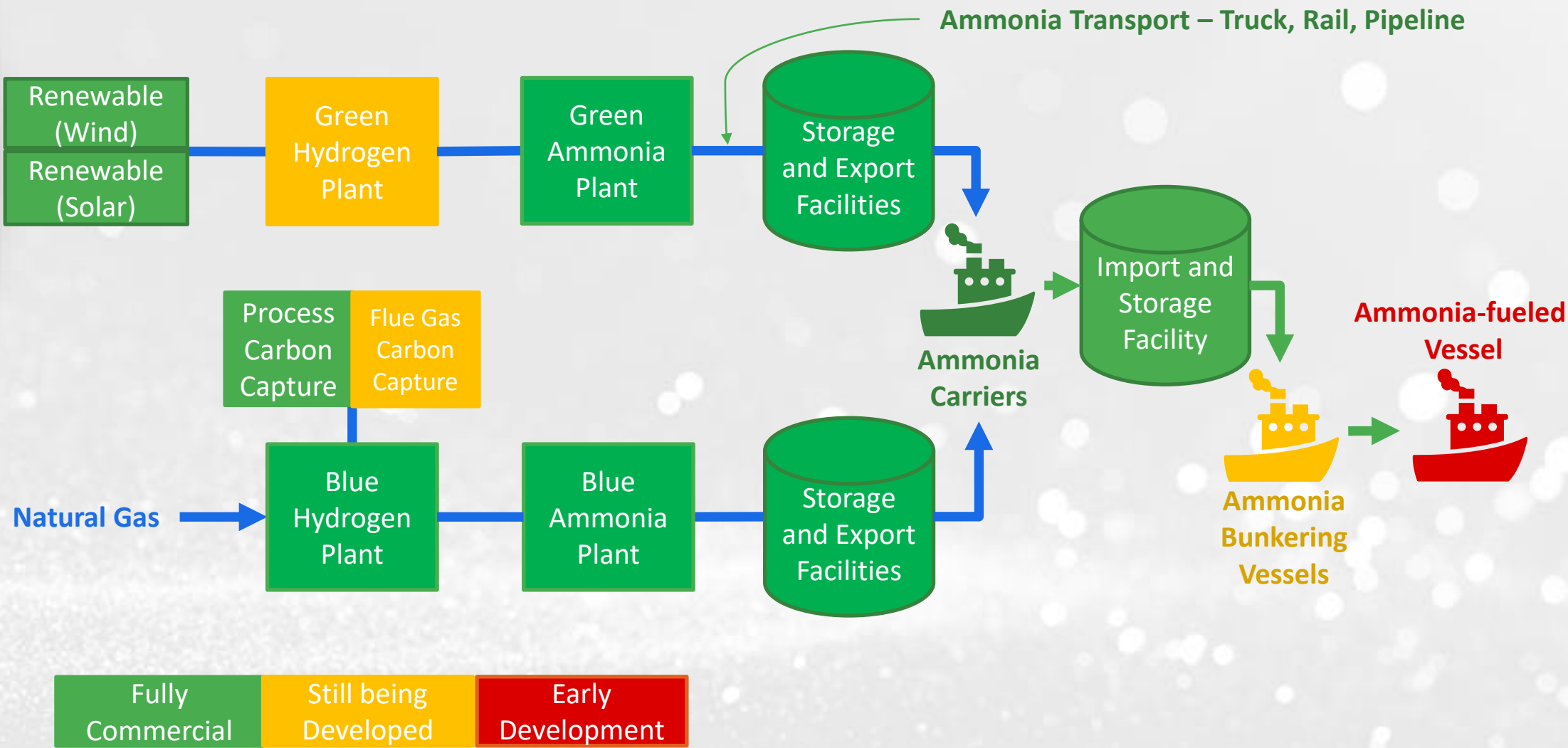


Ammonia Value Chain - Bunkering in Port of Singapore

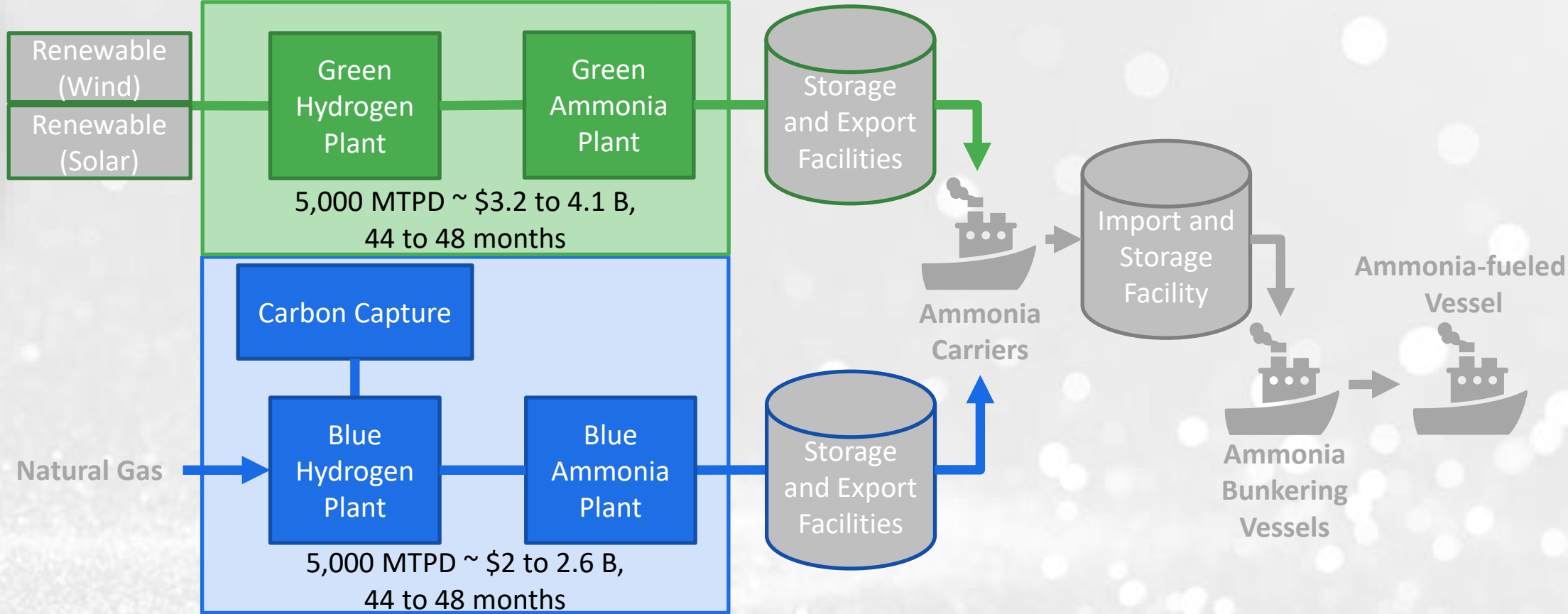


Substantial infrastructure will be required to support ammonia marine fuel at the Port of Singapore

Ammonia Value Chain - Commercialization

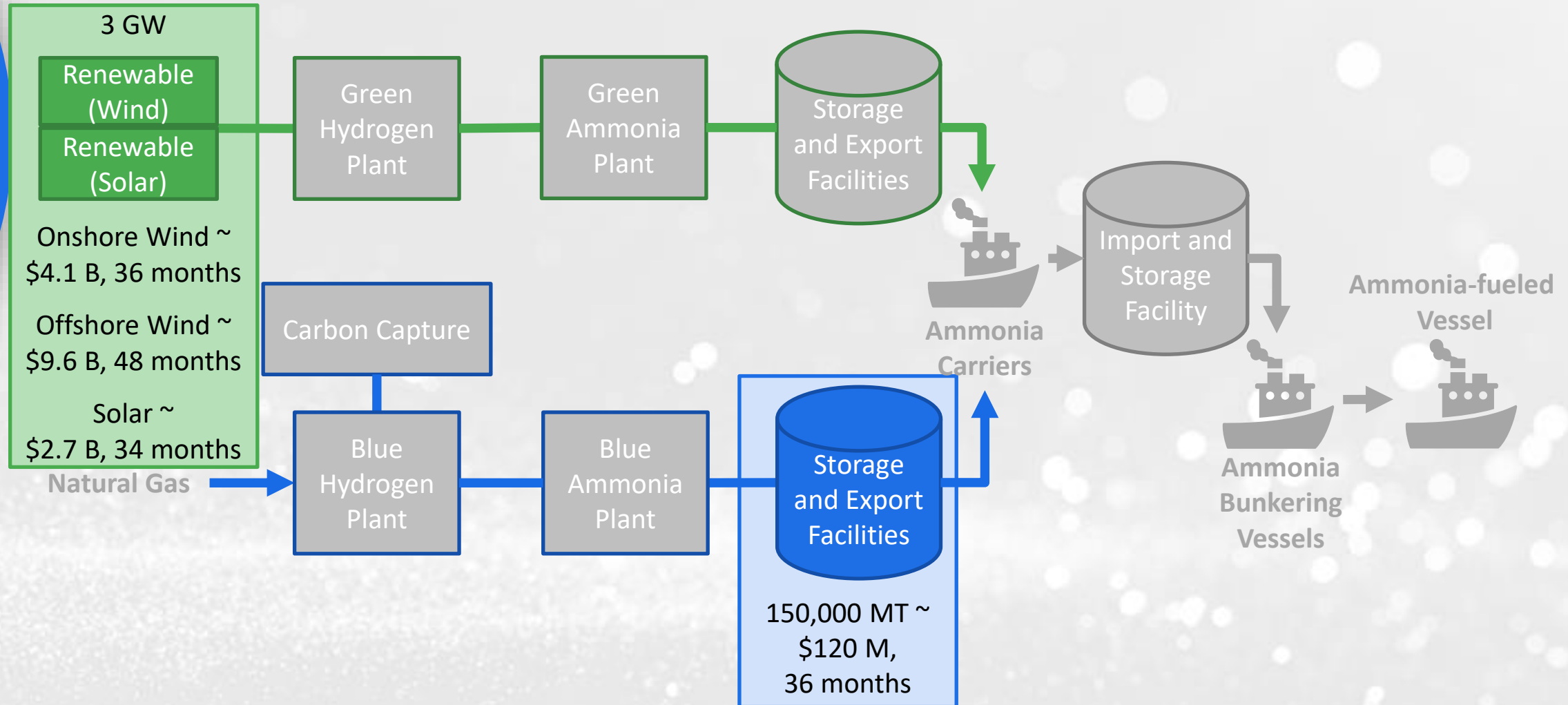


Ammonia Value Chain – TIC Cost & Schedule



Conventional Ammonia (grey) 5,000 TPD ~ \$1.8 to 2.4 B, 44 to 48 months

Ammonia Value Chain – TIC Cost & Schedule



Green/Blue Ammonia in Singapore

- Green/Blue ammonia infrastructure investment will be substantial
 - New renewable power
 - New ammonia plants
 - Ammonia transport (pipeline, truck, rail)
 - Ammonia import/export
 - Ammonia vessels (transport, bunkering, ammonia-fueled)

For 30% replacement of Port of Singapore fuels – 27.5 Million MTPA required



Contact Us

bv.com

CheongHW@bv.com