Distribution of Ammonia as an Energy Carrier

Engineering, procurement, consulting and construction company

100-year legacy of sustainably solving global infrastructure challenges

History of successful projects

Committed to sustainability

Michael Goff, Ph.D., P.E.

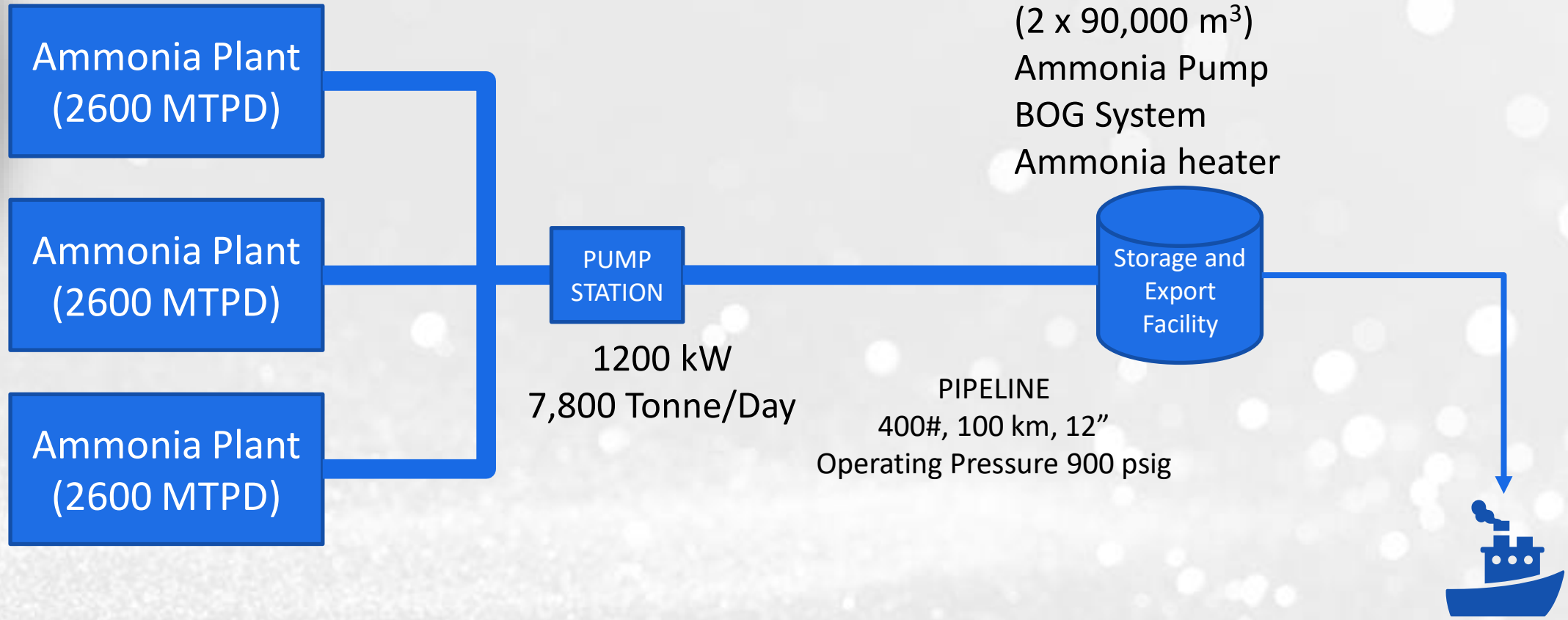
Technology Manager; Syngas, Fuels, & Chemicals

BLACK & VEATCH

Existing Ammonia Infrastructure

- Annual ammonia production over 180 million tons
- Global maritime trade of 18 million ton/yr
- Over 120 ports
- 170 ships
- Significant pipelines in USA, Russia, and Ukraine

Ammonia Infrastructure (transportation, storage, export)



Infrastructure Basics for “Hypothetical” Infrastructure

Item	Specification	Remark
Shipment Capacity	50,000 Tonne (80,000 m^3)	Once per week
Export facility	2 x 60,000 Tonne (Ammonia Storage Tank)	
Pipeline	12” , 5LX, Gr X46, 400# Underground	Construction cost depends on the pipeline profile, number of road/river crossing, urban, rural, etc
Ammonia Pump Station	7,800 Tonne/Day , 1200 kW	Every 100 km in flat area
Equivalent power generated	1200 MW	Power generation plant efficiency : 60%

Transmission Energy Sources Comparison

Product	Boiling Point °F (°C)	Density (at 900 psig, 60°F) lb/ft³ (kg/m³)	Energy Density (at 900 psig, 60°F) BTU/ft³ (kJ/m³)	Specific Energy BTU/lb (kJ/Kg)	Mass Flow Rate(1) lb/hr (kg/hr)	Pipeline size (in)	Power Required HP (2) (kW)	Relative Cost
Natural Gas	-260°F @ 0 psig (-160°C @ 0 barg)	3.39 (54.3)	75,600 (2,814,000)	22,300 (51,820)	310,400 (140,800)	16	4,820 (3,600)	Base
Ammonia	84°F @ 150 psig 213°F @ 900 psig (29°C @ 10 barg) (101°C @ 62 barg)	38.5 (616)	372,700 (13,860,000)	9,680 (22,500)	716,500 (325,000)	12	1,610 (1,200)	0.5
Hydrogen	-423°F @ 0 psig (-253°C @ 0 barg)	0.32 (5.16)	19,360 (721,110)	60,130 (139,750)	113,650 (51,550)	18	17,850 (13,320)	2.2

1. Equivalent to 1200 MW power generation fuel supply at 60% efficiency
2. Based on 100 km pipeline
3. All heating values are higher heating values

Contact Us

bv.com
Michael Goff
GoffMJ@bv.com
+1 913 458 7918