



Modular, carbon-free NH₃ fuel production & use

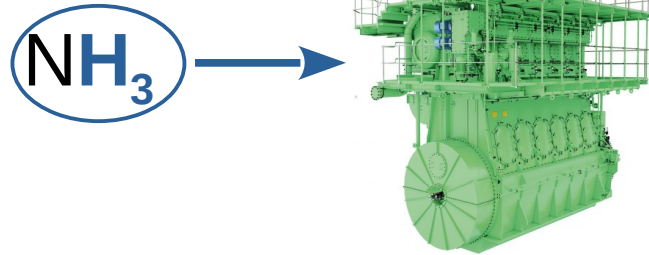
6 May 2021

Ammonia is how hydrogen will succeed

Hydrogen
Carrier



Direct
Fuel



Ammonia provides practical TWh storage



Hornsdale Power Reserve
Batteries

1220 tonnes on 1 hectare
129 MWh

1x

Cape Canaveral
Liquid hydrogen

270 tonnes at $-253\text{ }^{\circ}\text{C}$
8,999 MWh

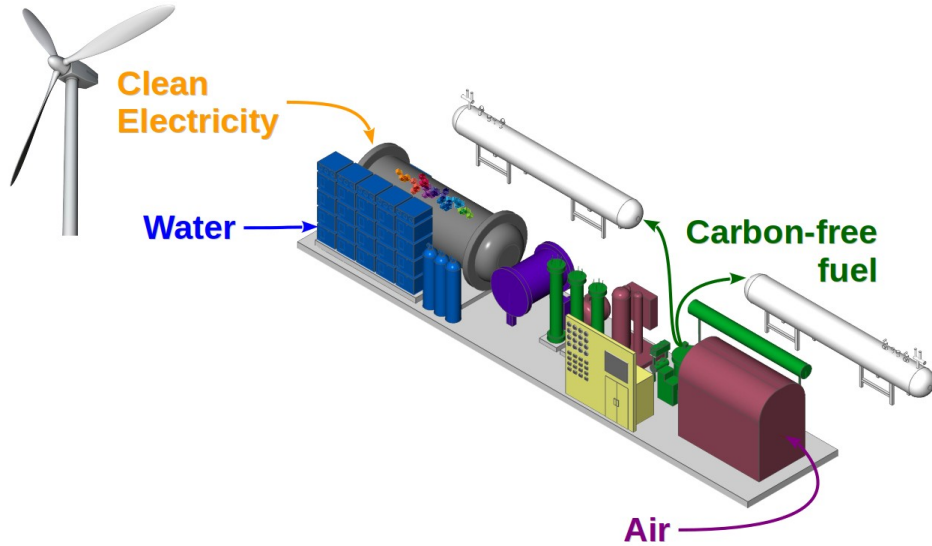
70x

Many Locations
Liquid ammonia

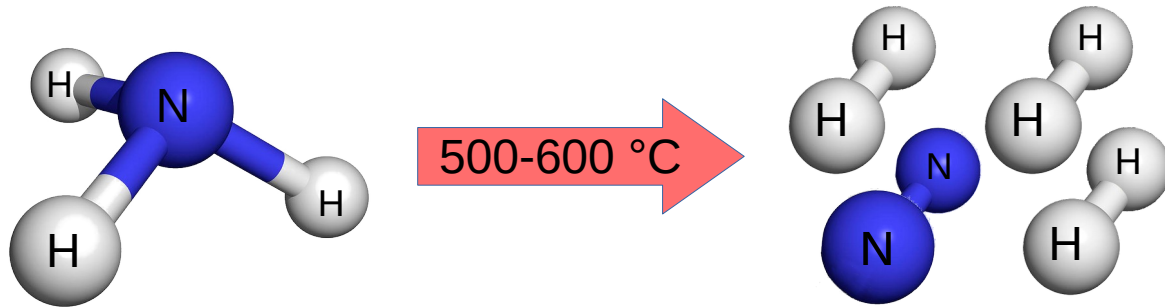
60,000 tonnes at $-33\text{ }^{\circ}\text{C}$
312,000 MWh

2418x

Renewable ammonia production & use



Rapid Ramp NH_3
Ammonia from air, water, & clean electricity



Prometheus Carbon-free Fire
Lower temperature ammonia cracking

Most components commercially available

Ammonia Synthesis
Proprietary

Ammonia Storage
Commercial

Nitrogen
Commercial

Ammonia Liquefaction
Commercial

Air Compressor
Commercial

Ammonia Removal
Proprietary

Hydrogen
Commercial

Circulation Pump
Commercial

Starfire Energy Technology
Highly active catalyst
Metal monolith bonding
Adsorption ammonia removal
Fast adsorbent regeneration

Benefits
Low pressure operation
Follow variable power
No gas storage
No power buffering
Modular systems

Developers want products, not projects



Modular systems provide:

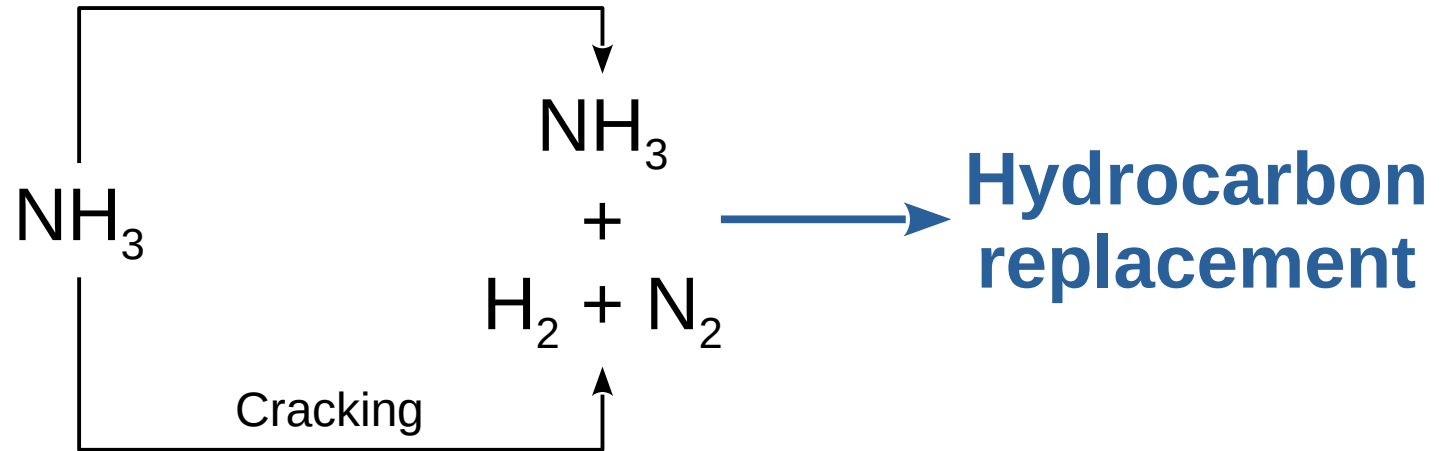
- Easy bidding process
- Consistent plant cost
- Fast, repeatable deployments
- Easily increased plant capacity
- “Learning curve” cost reductions

Ammonia cracking gives application diversity

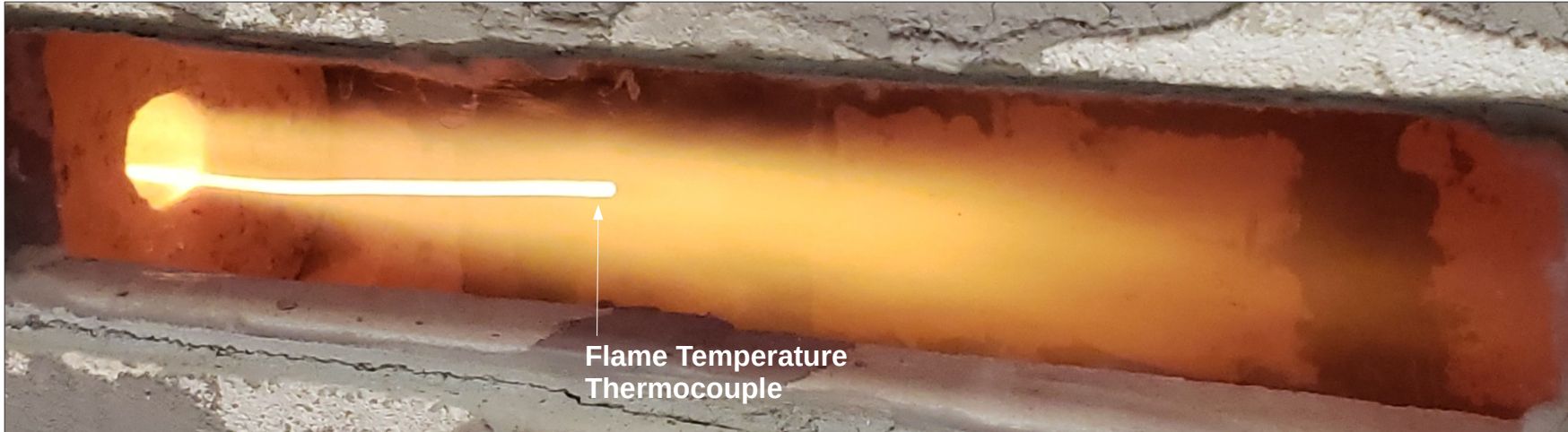
Low-temp
fuel cells



Combustion
fuel



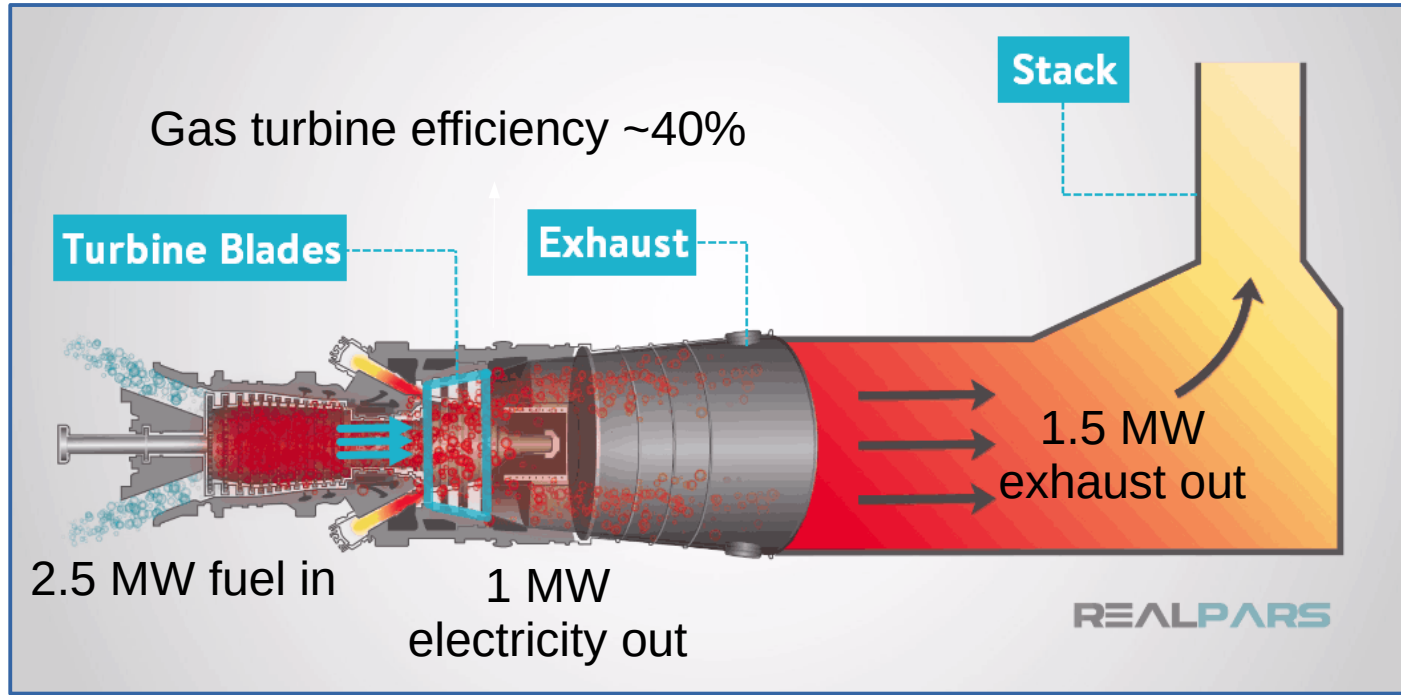
Pure + cracked NH_3 burns like natural gas



38kW burner flame, 70% mole fraction ammonia, 30% cracked ammonia (H_2 and N_2). Photo credit: Jenn Beach

- Commercial natural gas burner
- 70% NH_3 + 30% simulated cracked NH_3
- Carbon-free fire!

Starfire cracking will use turbine waste heat



Starfire Cracking Tech

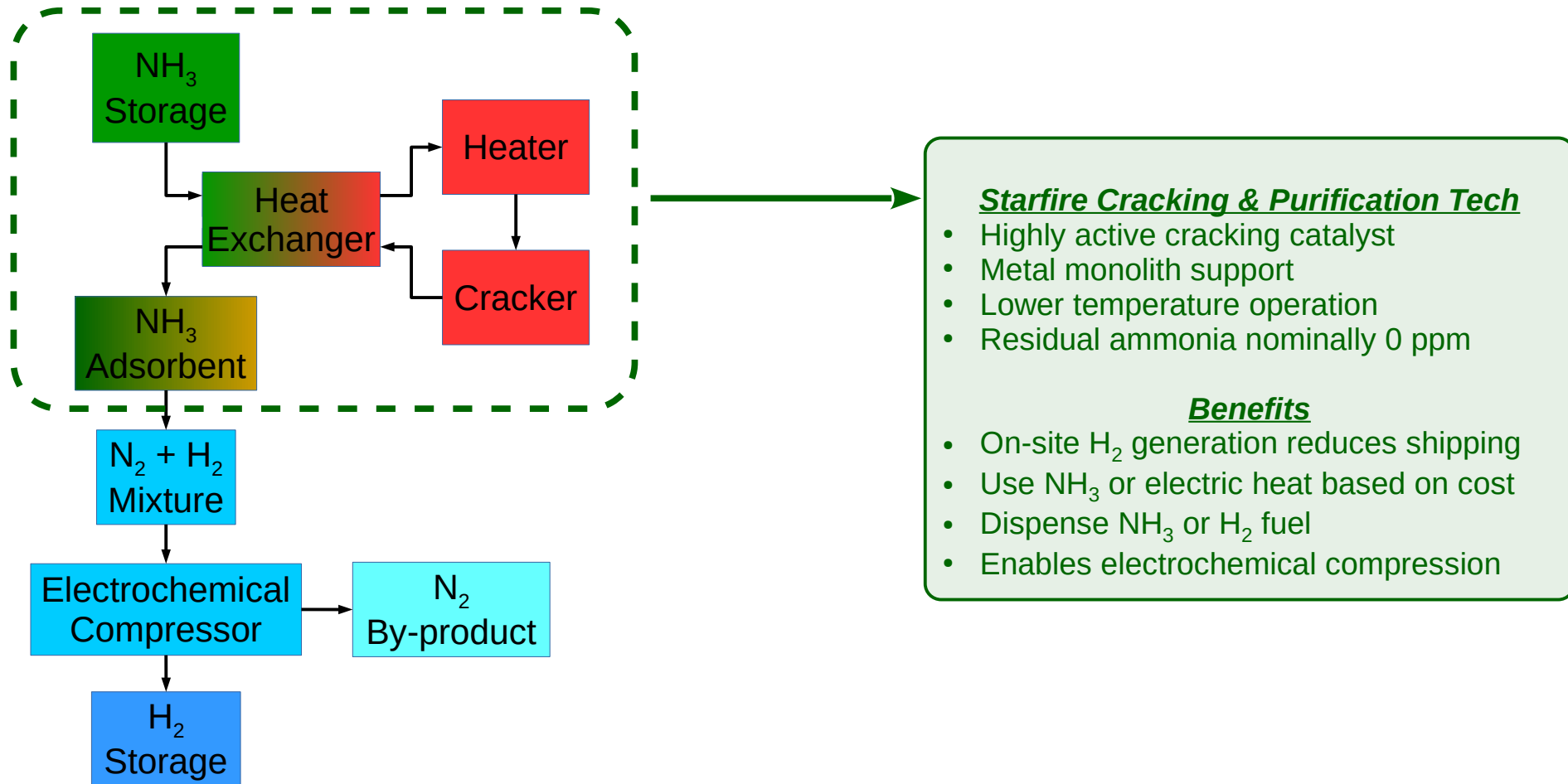
- Highly active catalyst
- Metal monolith support
- Lower temperature

Benefits

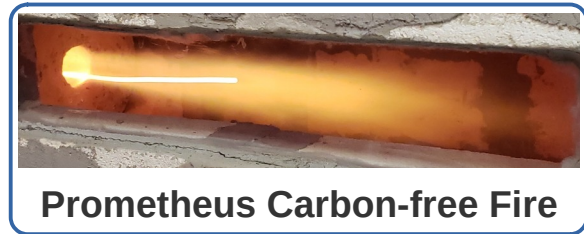
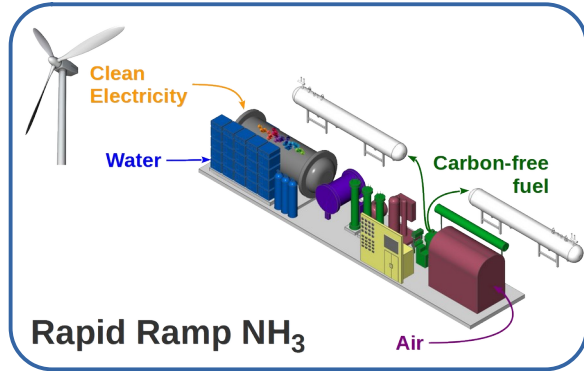
- Use “free” exhaust heat
- Low pressure

- 70/30 blend: 0.183 MW heat input for cracking
- Hot exhaust becomes useful heat for cracking

Starfire tech helps deliver hydrogen



Parallel scale-up and deployment



2021	2022	2023	2024
100 kg/day, modular autonomous field ops	Optimal shipping scale, pilot sales	Pilot operations	50 tonne per day systems
2021	2022	2023	2024
20 kg/h, thermal integration	300 kg/h, elevated pressure	Combustion application customization	Large scale hydrogen delivery

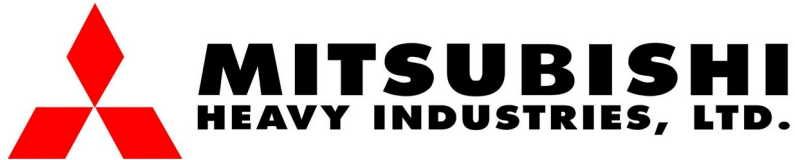
Fantastic Series A closed in March



APVentures
ADVANCE & PIONEER



NEW ENERGY TECHNOLOGY





I'm happy to answer questions during the panel discussion.