



Starfire Energy

MAKING SUSTAINABLE ENERGY A REALITY

Hydrogen: Possibilities & Roadblocks

CREA Energy Innovations Summit 2022

Joe Beach, CEO & Founder

Working with hydrogen is difficult & expensive



- Liquid: $-253\text{ }^{\circ}\text{C}$, colder than Pluto
- Gas: 700 bar, heavy or expensive tanks
- Smallest molecule: leaks more likely
- No odor: leaks hard to detect
- Low ignition energy: leaks ignite easily
- Wide explosive range: leaks can detonate

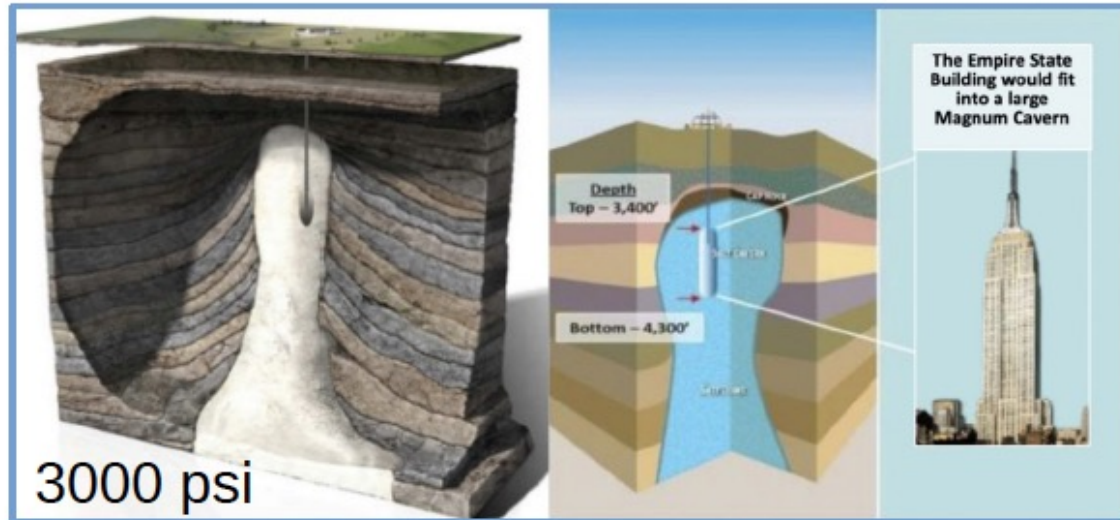
Ammonia is carbon-free & has good logistics



- Liquefies easily: $-33\text{ }^{\circ}\text{C}$ or 10 bar
- Inexpensive steel tanks and pipes
- Strong odor – leaks immediately noticed
- Nearly impossible to detonate
- Global distribution already developed



Ammonia allows grid scale storage anywhere



Subsurface pressurized hydrogen

300,000 MWh

Days of full power grid

~\$30-\$40M + *cushion gas*

Must have salt dome



Chilled liquid ammonia

312,000 MWh

Days of full power grid

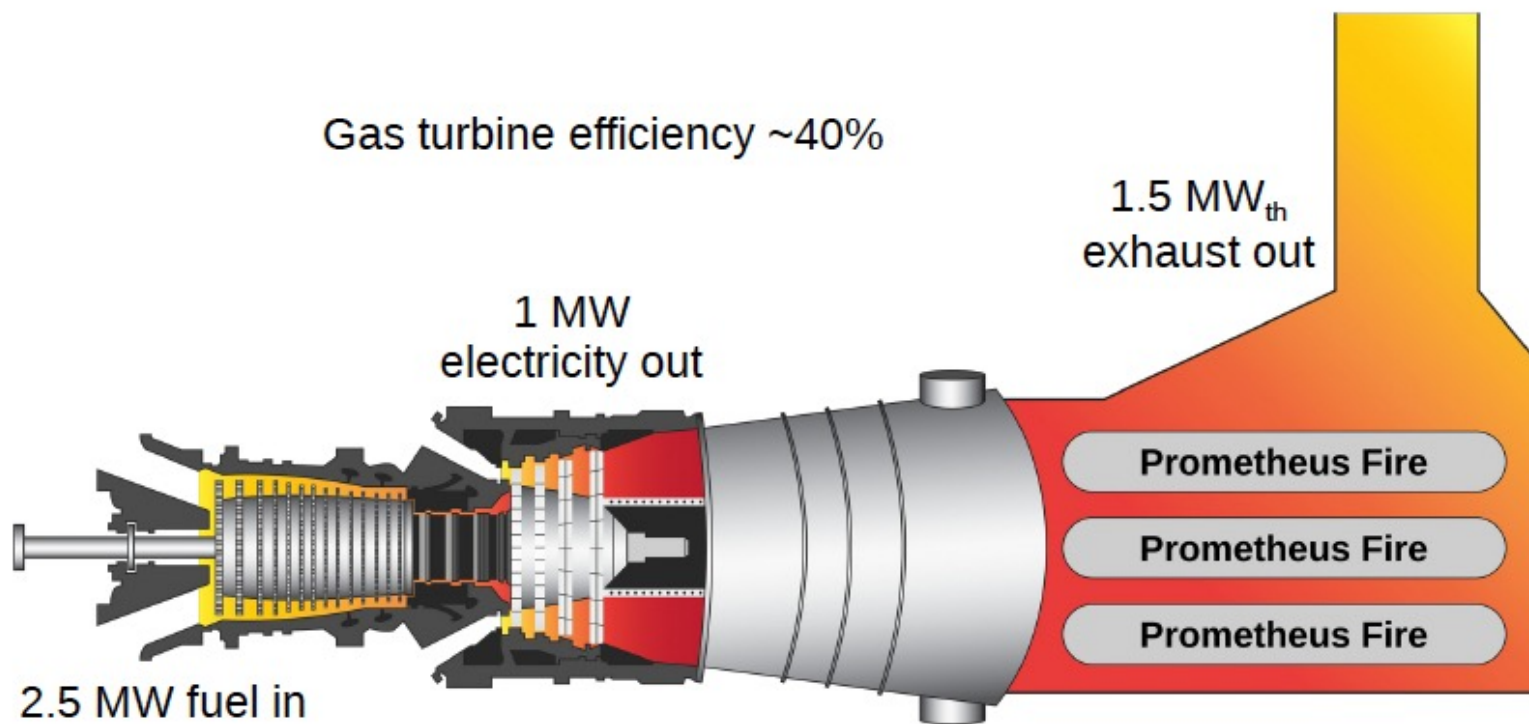
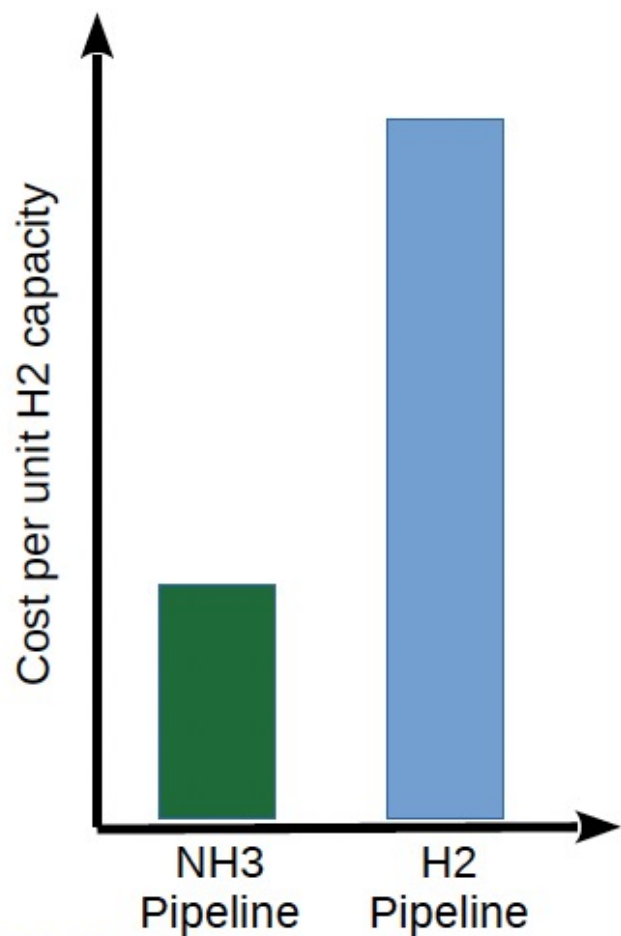
~\$30M

Any location

Cheaper transport pushes ammonia to end use

NH₃ pipelines less than 1/3 cost of H₂ pipelines

70/30 "Pure + cracked" blend burns like gas
Exhaust heat utilization reduces cost





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**Please ask questions during the
panel discussion**

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