



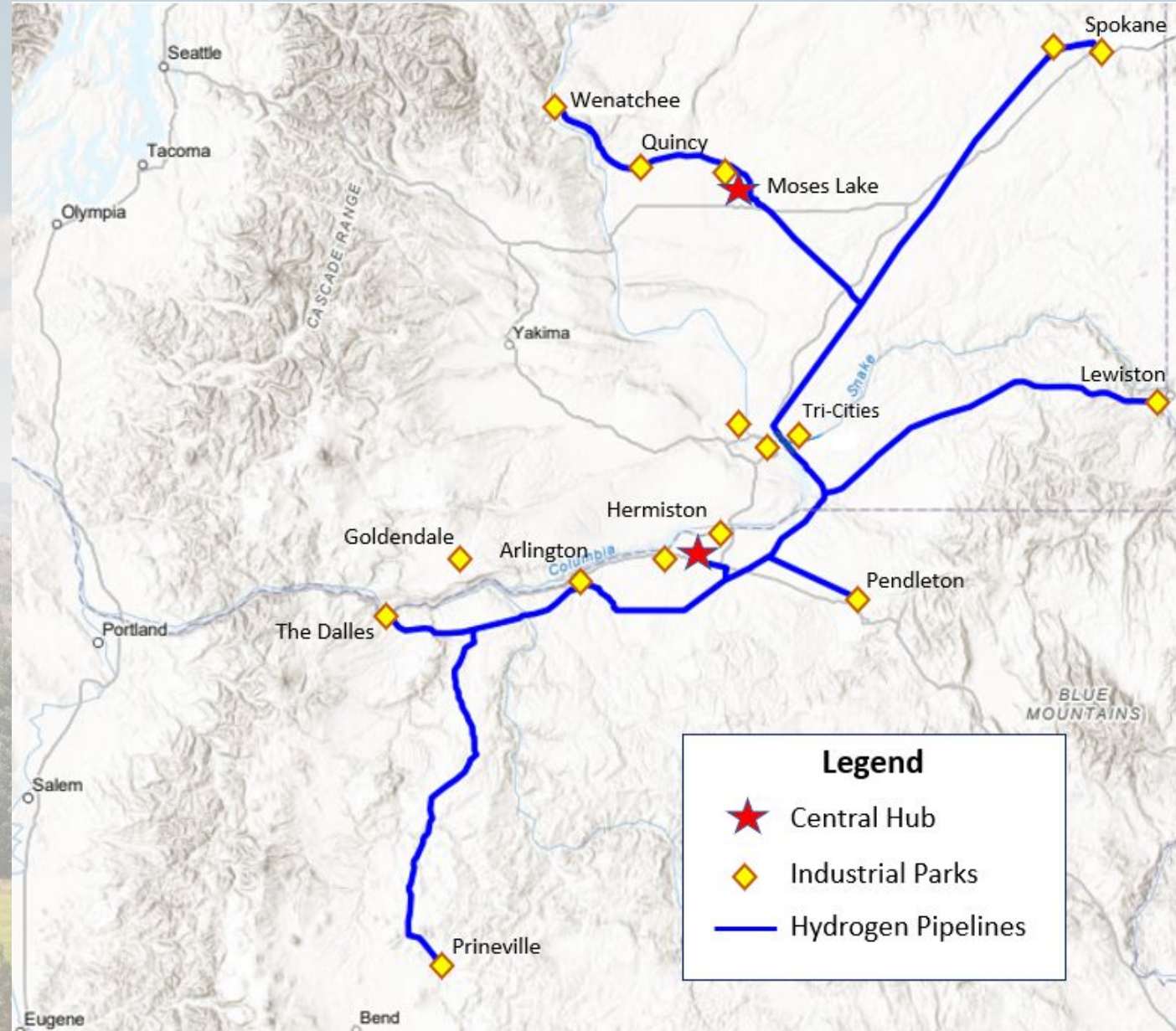
Obsidian Pacific NW Hydrogen Hub

By Abraham Mooney

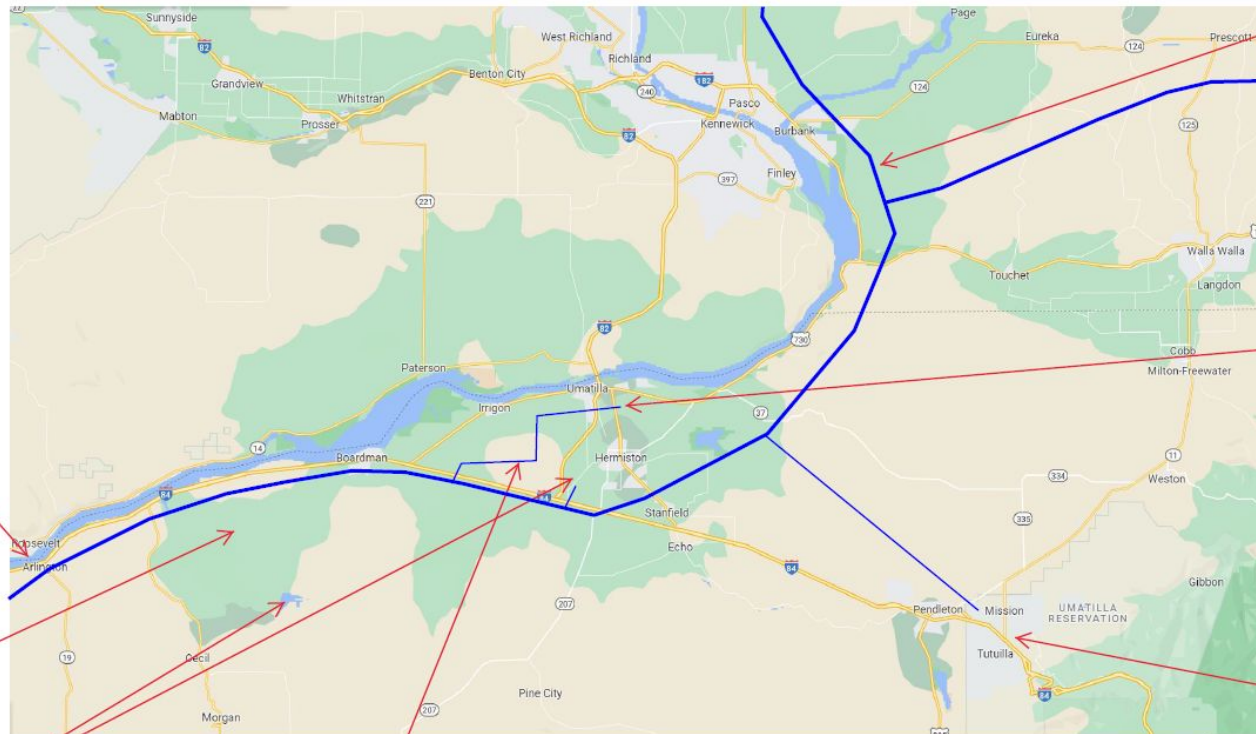
Hydrogen Hub Critical Step to Decarbonization

A Regional Solution:

- Least Cost Energy
- Industrial Feedstock
- Collect/store RE across the region
 - Electrolysis
- Deliver H2 to
 - Ports,
 - Data centers
 - Industrial parks
- Fertilizer, NH3 feedstock
- The DFG: Dispatchable Firming Generator



Obsidian's Pacific Northwest Hydrogen Hub Initiative



Hydrogen electric trucks haul garbage from Portland and refuel in Arlington



Hydrogen to Farms Initiative enables sustainable farming through local energy and fuel generation



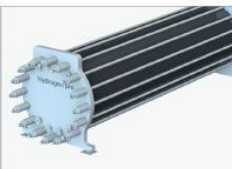
Gas Turbine, powered by Hydrogen



Purpose-built Solar & Wind
200 MW PV on 1200 acres



1000 tonne H2 Storage Manifold Co-Located under Solar Field



Electrolyzer - 200 MW



Nitrogen Fertilizer Plant:
450 tonne/day



Hydrogen Storage Pipeline connects OR, WA & someday, Lewiston, ID



Data center back up power - Hydrogen replaces diesel fuel



Arrowhead Travel Plaza with Hydrogen Fueling Stations

Obsidian's Oregon Hub at The Depot



Using Renewable Hydrogen: Nitrogen Fertilizer Production

Fertilizer: $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3 + \text{heat}$

Price Volatility

Locally, lower cost

Using Renewable Hydrogen:

Backup Generators and Emergency Power

The pipeline stores thousands of tons of hydrogen for Power generation:

1. Utilities need to balance wind and solar generation
2. Data Centers need:
 1. Back up Power that does not pollute
 2. Dispatchable power when grid power is expensive



Using Renewable Hydrogen: Commercial Transportation

1. Currently, largest emitter of greenhouse gasses.
2. Hydrogen EVs are EVs
3. Faster fueling times
4. Longer range than EVs
5. H2 infrastructure vs electricity infrastructure



Hydrogen on the Farm

By Abraham Mooney

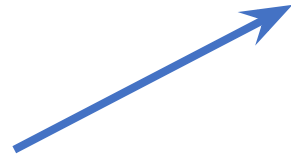


Solar and Wind

Renewable Energy: 6 acres = 1MW

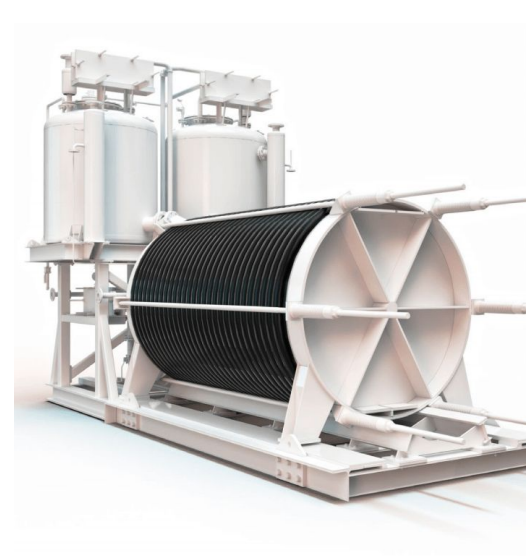


- Automation – autonomous tractors, robotic weed control
- Storable/Portable – piping to neighboring farms
- Resilience - power outages, climate change

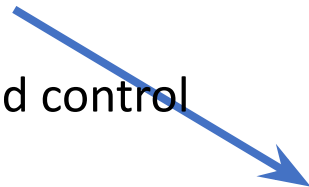


Hydrogen
Production
via

Electrolyzer:
500 – 750 kw



&



Tesla
Powerwall:
500 kwh



Benefits of Hydrogen on the Farm

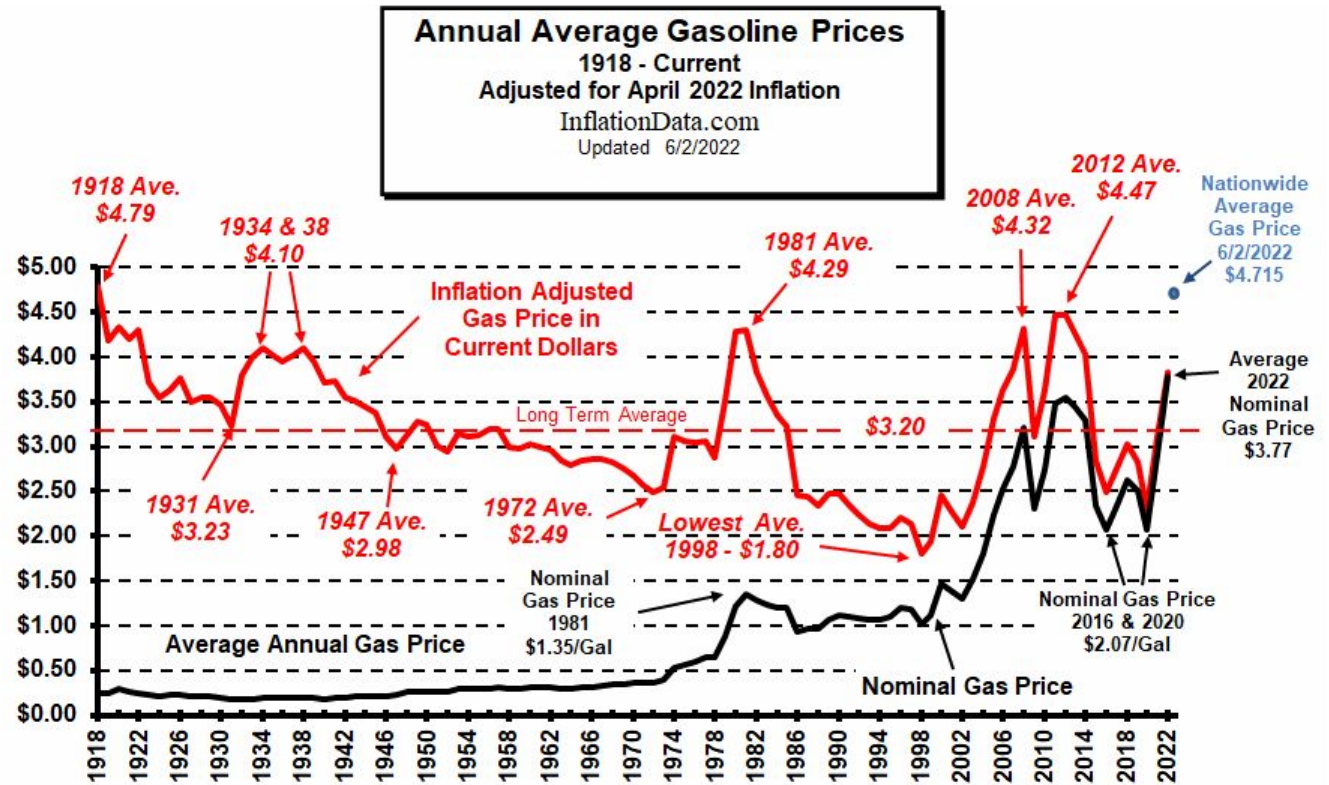
- Less expensive fuel:
 - HEVs: Tractors, trucks, ATVs
- Decreased maint. costs.
 - TCO HEVs is less than ICE
- Generators – mobile power plant
 - e.g. F150 Lightning (BEV) or
 - F550 H2 truck (HEV)
- Proprietary control farm energy
- Irrigation Pump Elect. Resilience



Volatility of Fossil Fuel Markets

Avoid
Uncertainty:

Use Renewable Energy and Storage



Note: Prices are Average Annual prices for Retail Regular Gas not Peak Prices so peaks are smoothed out

Source of Data: US Energy Information Administration
CPI-U Inflation index- www.bls.gov

Please include a link to original when using this chart



Managing risk

Production risks

Market Risks

Financial Risks

Legal Environmental Risks

Fuel Cost Risk



Hydrogen On the Farm

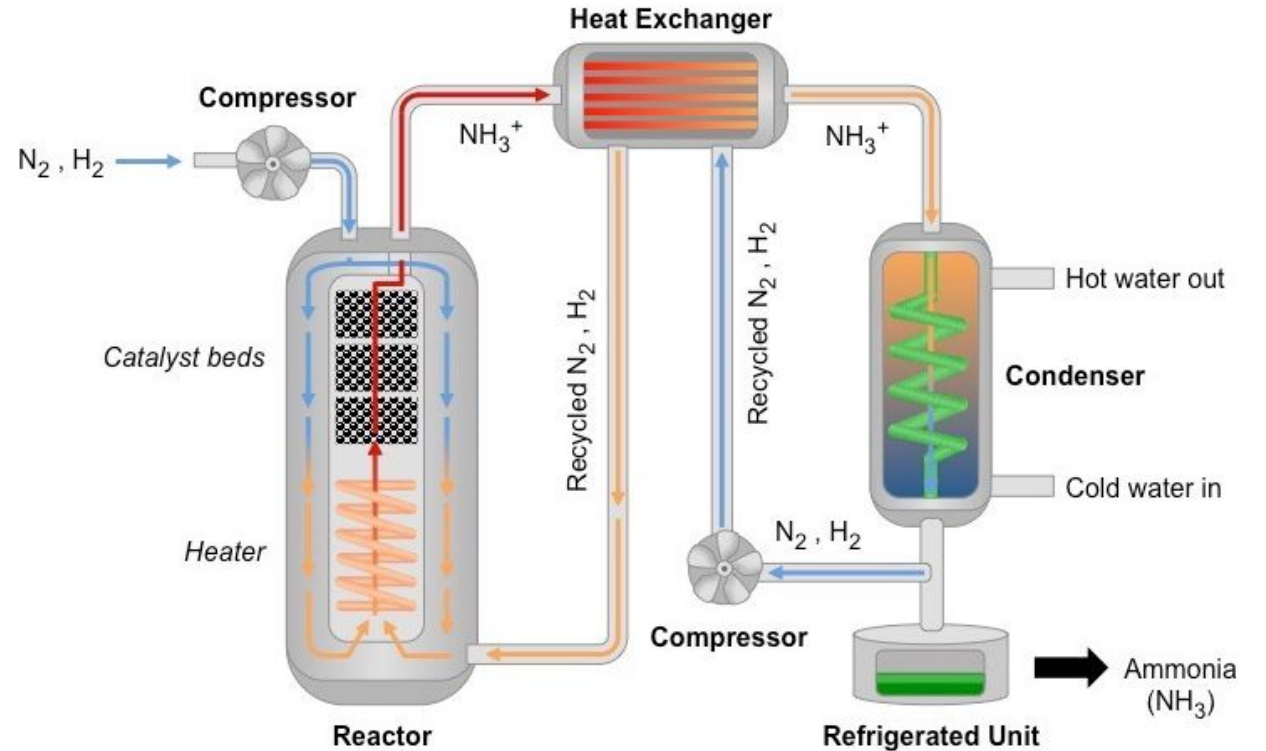
Working Group



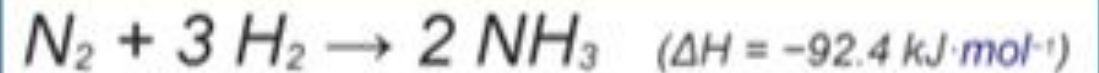
On Farm Fertilizer Production

Haber Bosch – Ammonia Production

Not yet commercially available



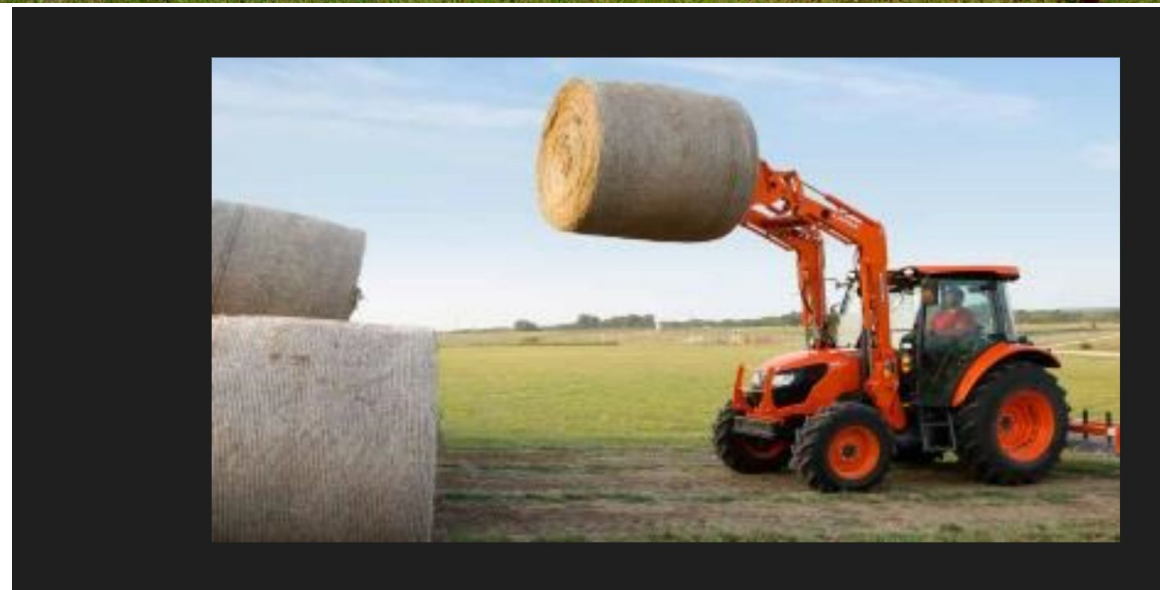
Haber-Bosch Reaction



Thank You!

Hydrogen on the Farm

By
Abraham Mooney



Farming Before Fossil Fuels

- 40% of farm land – feed for work animals.
- If photosynthesis is 1% efficient
 - Sun to biomass/nutrients as feed

And solar PV to hydrogen is 10% efficient

- Then 10x improvement means:
 - **4% of land for energy collection,**
-not counting wind

