



AMMONIA ENERGY
ASSOCIATION

Ammonia Energy Conference 2024

Technology Track: Deploying Electrolytic Hydrogen for Ammonia Plants: Lessons Learned

Chair: Emily Wolf (Ambient Fuels, emily.wolf@ambientfuels.com)

Wed Nov 13, 2024 @10.00u-12.00u
Ammonia Energy Association

Industries We Serve



Our solutions enable our customers to achieve low-carbon goals by displacing fossil fuel consumption and positions them to be first-movers in the next phase of the clean energy transition



 Ammonia	 Power Generation	 Refineries
 Manufacturing	 Chemicals	 Shipping
 Aviation	 Heavy Road Transport	 Metals

Experienced & Grounded

Rooted in chemicals processing & renewables development, we are “pipes and wires” folks

We've collectively developed and/or contracted:

10 GW Renewable Energy Projects	1 BCF Chemical Processing Facilities	200 MW Electrolyzer Projects
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Why Trust Ambient Fuels

Tech Agnostic Project Design

Our collaborative approach to project scope and specification puts you in the driver's seat

Strong Relationships With...


Electrolyzer OEMs ▶ Renewable Energy Suppliers ▶ + Other Partners

Provides the best, lowest-cost technology and capabilities which in turn means the most cost-effective project for your needs

Focused & Knowledgeable

We're one of the first and few pure-play green hydrogen developers

Our collective and growing knowledge base means we can focus on:

 **OPTIMIZING**
Project Design

 **IMPROVING**
Project Outcomes

Backed by Generate Capital

\$250 million ▶

Committed to Ambient Fuels and our pipeline of projects

SINCE 2014

Raised **\$10 billion** of Capital

Invested Over **\$6 billion** Infrastructure

Together with **50+** Partners



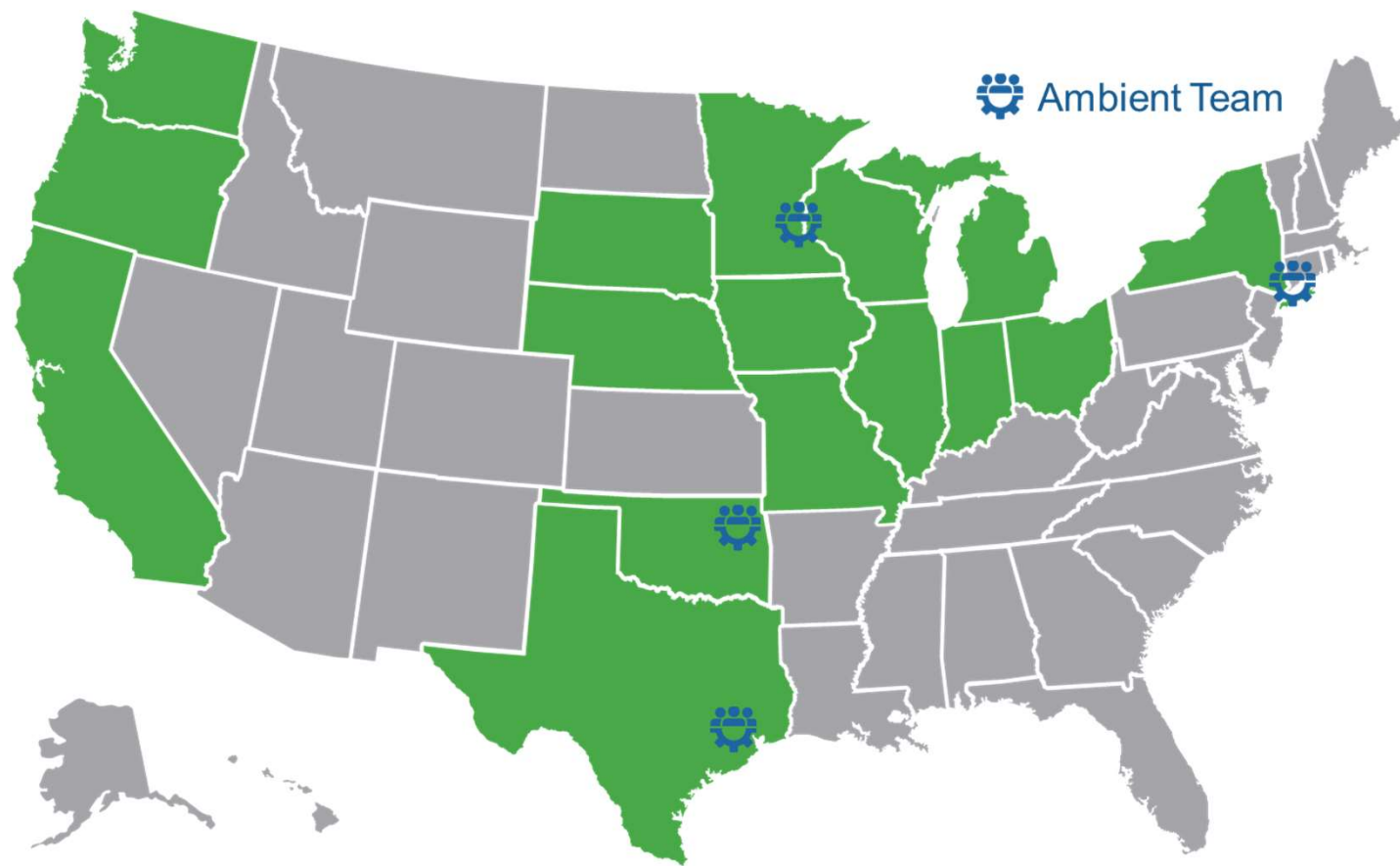
Our Presence



16 states

7 power markets

1750 TPD in development



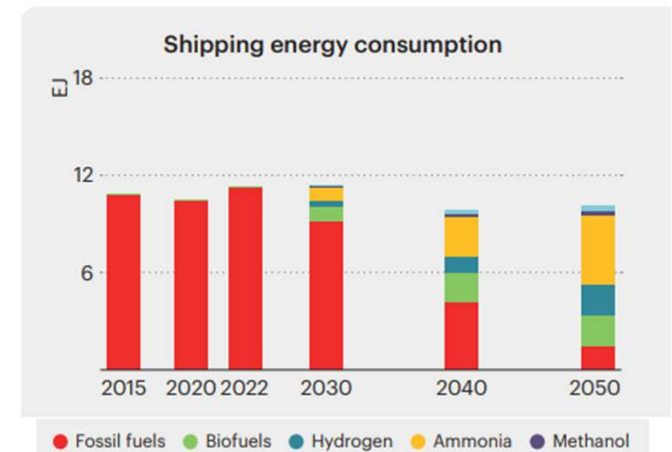
As of 10/1/2024

Green ammonia has a significant role to play in decarbonization



Green ammonia can play a role in decarbonizing hard to abate sectors such as heavy industry, shipping, power generation and agriculture and play a leading role as a hydrogen energy carrier

- Well developed production technologies
 - Ability to utilize in commercially demonstrated Haber-Bosch technologies
 - Increased demonstration and commercialization of electrolyzer technologies
 - Not new – Norway starting in 1920s
- Already transported, stored and utilized globally
- Significant investment in development in end use technologies for new applications
 - Power generation, marine, cracking to hydrogen
- Decarbonization goals of companies downstream in agricultural supply chain
- Large producers already investing



Green ammonia production is developing and entering operations ...



A few projects have entered commercial operations with several others reaching FID and many others in advanced development

- Already happening (select projects)
 - Iberdrola and Fertiberia project in Spain starting in 2021
 - Yara project in Norway starting in 2024
 - Skovgaard demonstration project in Denmark, starting up Q1 2025
- Projects already reached FID (select projects)
 - NEOM (Saudi Arabia)
 - Fertiglobe (Egypt)
 - CF Industries (US)

... but the emerging sector faces several challenges



Cooperation across the value chain is required to develop significant production required to decarbonize hard to abate sectors

- Economic feasibility
 - Requirement for long-term offtake
 - Capital costs
 - Power procurement costs
 - Competition for renewable energy
 - Intermittency impact on utilization (requirement for battery or hydrogen storage)
- Insufficient demand incentives
- Regulatory definition still required
- Infrastructure development required
 - Storage and bunkering (only < 20 MM MTPA of merchant ammonia traded globally per annum)
- End use technologies still under development

Session format



- 85 min of presentations on Renewable Ammonia Production via Water Electrolysis (15 min presentation + 5 min Q&A)
- 35 min of panel discussion (introduction slides + Q&A)

When	What	Who
0.00u-0.05u	Introduction by session Chair	Emily Wolf
0.05u-0.25u	Presentation Topsoe	Bo Hartvigsen
0.25u-0.45u	Presentation NEL	Elliot Wingate
0.45u-1.05u	Presentation ABB	Doug Shore
1.05u-1.25u	Presentation Enaex	Pablo Wallach
1.25u-1.55u	Panel discussion	
1.55u-2.00u	Wrap-up by session	Emily Wolf



Ambient Fuels



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