



Panel Session: A Fuel Standard for Ammonia

November 17, 2020
Ronald Stanis PhD, Institute Engineer

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- Intro - Ron Stanis, Institute Engineer GTI / LCRI
- **Ammonia Standard Challenges**
- David Richardson, Eastern Region Sales Manager, Airgas
- **Low Carbon Fuels for Power Generation**
- Rob Steele, Tech. Executive Combined-Cycle Turbomachinery program EPRI / LCRI
- **IIAR Standards and Guidelines**
Eric Smith, VP and Technical Director, International Institute of Ammonia Refrigeration
- **Marine Fuel**
Dorthe M. Sveistrup Jacobsen, Principal Specialist, MAN Energy Solutions
- Poll questions in between speakers
- Review our poll Results
- Question and answer session

AEA Fuel Standards Committee

- We last met 9/2/2020
- Group is

David Richardson (Airgas),

Jenn Beach (Starfire),

Dr. Agustin Medina (Cardiff),

Trevor Brown

Bill Ayres (Renewable Solutions),

Emile Herben (Yara),

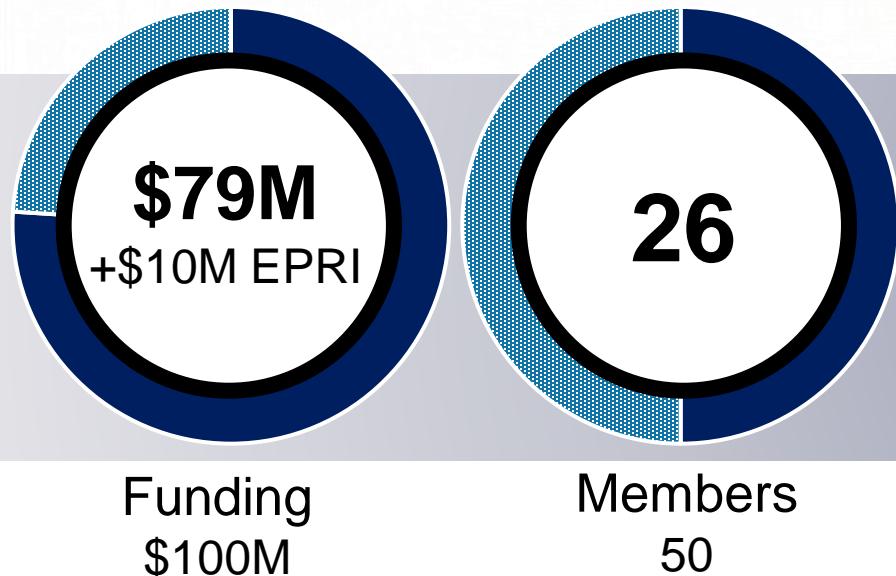
Dr. Ron Stanis (GTI),

- Not a standard to delineate green vs gray vs brown ammonia
- Ready to be used to gain acceptance for emissions regulations: Marine, Aircraft
- Lessons learned from biodiesel
- Water content and effects of stress corrosion cracking

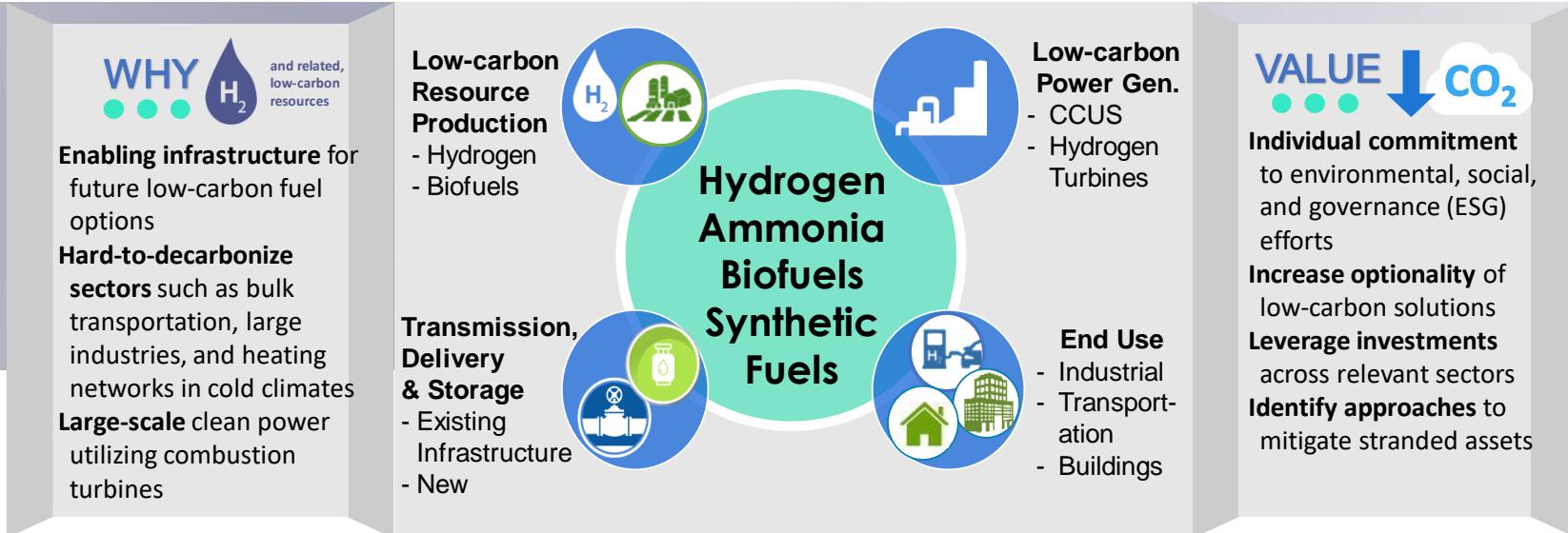
AEA Fuel Standards Committee

- We are addressing a mixed Community
 - Career ammonia Industry
 - Energy researchers looking for a carbon neutral fuel
- Standard purity testing
- Develop handling standard or guidelines?
- Materials compatibility
- Standards can take a long time
 - Need to engage industry and researchers and reach a consensus

Low Carbon Resources Initiative



The **Low-Carbon Resources Initiative** is a five-year, collaborative R&D commitment to reveal the pathway to advance low-carbon technologies for large-scale deployment approaching **2030**. Led by and funded through **EPRI** and **GTI**, the vision is to enable a risk-informed understanding of options and technologies for deep, economy-wide decarbonization, and advance these through applied engineering and technology acceleration.



GTI / LCRI Perspectives

- We are performing research
 - Cracking
 - Synthesis
 - End Use
- Looking at what is not being done
 - What impact can we create
- Putting together a roadmap for gas and electric utilities
- Looking at Environmental Health & Safety Aspects
 - Regulatory and permitting landscape is not clear to our members
 - Engineering challenges and retrofits

Poll Questions

1) What type of research are you performing for ammonia energy end use?

- a) Reciprocating Engines
- b) Gas Turbines
- c) Boilers (power generation and industrial/commercial applications)
- d) Cracking
- e) Fuel cells
- f) Other

2) What water content in ammonia is currently being used or considered for your R&D?

- a) 0%
- b) 0-499ppm
- c) 500ppm-4999ppm
- d) 5001ppm-20,000ppm
- e) 2-5%
- f) >5%

3) In what form will your ammonia fuel process use the ammonia?

- a) Vapor from a pressurized storage?
- b) Liquid from a pressurized storage?
- c) Atmospheric Tank?

4) Are you evaluating mixtures of commercial grade natural gas and/or hydrogen with ammonia?

- a) No
- b) yes: natural gas and ammonia
- c) yes: hydrogen and ammonia
- d) yes: coal and ammonia

5) What key impurities need to be monitored and limited in an ammonia fuel standard?

- a) Water and oil
- b) Light hydrocarbons
- c) Trace elemental contamination.