AEA Conference 2020 – Low Carbon Ammonia Certification
Blake Adair
Mgr, Innovation and Product Development
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"Our integrated sustainability strategy is addressing our most material ESG risks and providing solutions for a growing world."

Nutrien President and CEO, Chuck Magro
Nutrien has a unique global footprint and well positioned assets to supply low carbon ammonia today.

Nutrien is a leading global integrated ag solutions provider with over 7 million metric tons of ammonia production capacity and up to 1 million metric tons of low carbon ammonia production capacity. The company has a fleet of ammonia vessels with tidewater access at Geismar, LA.

Source: Nutrien

November 10, 2020
Low Carbon Ammonia Production at Nutrien via Carbon Capture and Sequestration (CCS)

1. **Syngas Production**
   - Steam
   - Natural Gas Feedstock & Fuel
   - **Syngas**
   - **Air**

2. **Syngas Treatment**
   - Nitrogen, Hydrogen
   - Carbon Monoxide
   - **Hydrogen**
   - **Nitrogen**

3. **Ammonia, NH₃ Synthesis**
   - Urea Production
   - Vent
   - CO₂ Infrastructure

**FOOTNOTES**

- **Steam**
- **Natural Gas Feedstock & Fuel**

**Syngas Production**

- **Low Purity (<15%) Carbon Dioxide**
  - ~0.6-0.8 MT CO₂/MT NH₃

- **High Purity (<95%) Carbon Dioxide**
  - ~1.2-1.3 MT CO₂/MT NH₃

**Urea Production**

**Vent**

**CO₂ Infrastructure**

**Syngas Treatment**

- **Nitrogen, Hydrogen**
- **Carbon Monoxide**
- **Hydrogen**
- **Nitrogen**

**Ammonia, NH₃ Synthesis**

- **Urea Production**
- **Vent**
- **CO₂ Infrastructure**

**High Purity CO₂** that was previously vented is compressed and sequestered underground **Permanently**
Nutrien’s Alberta Low Carbon Ammonia – Uniquely Positioned to Leverage New CO₂ Infrastructure

The Alberta Carbon Trunk Line (“ACTL”) is a 240km pipeline designed to transport CO₂ for Enhanced Oil Recovery (“EOR”) and/or future Permanent Sequestration Operations.

- **Operational @ Redwater since Dec 2019**
- **Up to 295k mt/yr CO₂**
- **Up to 245k mt/yr Low Carbon Ammonia**
  - **Process CO₂ (Alberta Footprint)**
    - ~340k mt/yr
    - Potentially limited by volumes reserved for future urea expansion / debottlenecking
  - **Combustion CO₂ (Alberta Footprint)**
    - ~1.3M mt/yr
    - Operational feasibility & recovery rates under review and potentially highly variable

- **Nutrien**
  - (Initial Partner)
  - Contracted Source of CO₂
  - Owner & operator of pipeline and compression infrastructure

- **enhance**
  - (Partner)
  - Owner & operator of EOR / sequestration infrastructure and purchaser of CO₂

Further utilization of the ACTL as a viable emissions mitigation is under evaluation.

- **~1.8M mt/yr**
  - Phase-1 Operating Capacity (~15M mt/yr @ Full Capacity)

- **~C$1.2B**
  - Total Project Cost
  - C$580M in Public Funding Committed

- **~170km South of Pipeline**

- **Total Targeted Emissions**
  - Up to 1.9M mt CO₂/year
Geismar, LA Low Carbon Ammonia – Uniquely Positioned to Export Low Carbon Ammonia

The 925 mile Denbury CO₂ Pipeline network is designed to transport CO₂ for Enhanced Oil Recovery (“EOR”) and/or future Permanent Sequestration Operations enabled by 45Q Tax Credit

Dock can handle 25 kMT – 45 kMT vessels

Operational @ Geismar since 2013

> 250k mt/yr CO₂
> 200k mt/yr Low Carbon Ammonia

Contracted Source of CO₂

Process CO₂ (Additional opportunities)

~90k mt/yr CO₂
~75k mt/yr Low Carbon Ammonia
Potentially limited by volumes reserved for future urea expansion / debottlenecking

Combustion CO₂

Denbury (Partner)
Owner & operator of EOR / sequestration infrastructure and purchaser of CO₂

> 300 kmt/yr

Operational feasibility & recovery rates under review and potentially highly variable

> 600 kmt CO₂/year

Total Targeted Emissions

Further utilization of the Denbury Network as a viable emissions mitigation is under evaluation
Joffre, AB Low Carbon Ammonia – Utilizing By-Product Hydrogen to make Low Carbon Ammonia

By-Product Hydrogen and Nitrogen are Supplied from adjacent facilities

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Joffre NH₃ Facility
Nova/Praxair
Source of Hydrogen and Nitrogen

NH₃ Terminal
NH₃ Producer

490k mt/yr
Low Carbon Ammonia Capacity

Further expansion of Joffre possible with additional green energy or green hydrogen supply
Critical Values/Objectives for NH₃ Certification

- Fair evaluation of life-cycle carbon emissions for all pathways based on sound science

- Transparent process with adequate checks/balances to ensure international credibility

- Balance of ease of execution/complexity for both producers and consumers

- Support for early adopters (i.e. Hybrid Electrolysis/CCS facilities)

- Alignment with parallel hydrogen certification efforts
Thank You!

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