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<td>Presentation - Hydrogen and its role in the Energy Transition</td>
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<td><strong>Description:</strong></td>
<td>4C. Dave Edwards, Air Liquide</td>
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<td><strong>Filer:</strong></td>
<td>Raquel Kravitz</td>
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Hydrogen and its role in the Energy Transition

Dave Edwards

Director and Advocate for Hydrogen Energy
Air Liquide
Air Liquide: Key Figures

- **Net Profit (Group Share):** €2.24bn
- **Revenue:** €21.9bn
- **Investment Decisions:** €3.7bn
- **Present in:** 80 Countries
- **More than:** 3.7 Million Customers & Patients
- **Employees:** ~67,000

Gas Types:
- **O2:** Oxygen
- **N2:** Nitrogen
- **Ar:** Argon and Rare Gases
- **H2:** Hydrogen
- **He:** Helium
- **CO2:** Carbon Dioxide
- **CO:** Carbon Monoxide
Air Liquide has nearly 50 years of hydrogen development

**Production & Supply chain**

- Production
- Supply chain

**Distribution Networks**

- US Gulf Coast
- Northern EU
- Singapore

**Markets Segments**

- Process industries
  - Oil & Gas
  - Steel, Glass
  - Electronics
  - Transportation
  - Space

**Key Figures**

- 14 Bm³/yr
- 1,850 km H₂ pipeline
- 46 large H₂/CO plants
- 40 electrolyzers in operation
- 2 B€ sales

Air Liquide
Air Liquide investments in North America

1st large scale renewable liquid hydrogen production plant dedicated to the Hydrogen energy markets

- **Investment:** $250M
- **Capacity:** 30 tons per day (40,000 FCEVs in the West Coast)
- **Location:** North Las Vegas, Nevada
- **Construction:** Began in 2020; operations & delivery in 2022

World’s Largest PEM Electrolyzer to supply ~100% low-carbon hydrogen for Canada and the East Coast Markets

- **Investment:** $40M (additional investment to existing site with liquefier)
- **Capacity:** >8 tons per day (20 MW PEM electrolyzer)
- **Location:** Bécancour, Québec
- **Construction:** Began in 2019; operations & delivery started 2021
North Las Vegas Reformer & Liquefier
Becancour - Reformer, Electrolyzer, Purifier & Liquefier
The Challenges of Biogas

Cost of Purchasing Environmental Attributes (EA)
There are no EPA RFS approved H2 pathways
- Pathway approvals in process - waiting more than 6 years
- Market price of EA established by LCFS & RFS for CNG application
  - Hydrogen at a disadvantage, we pay a premium
  - If pathways are approved, this reverses

Availability of EAs - supply limited
AL Nevada plant requires ~2 large landfills or ~20 dairy digesters supply
EA purchases in large quantities with expiration dates
- Use them or lose them
- Customers demand 0 CI to maximize HRI
  - Requires combination of LFG and digester gas EAs

Credit Value Sharing
The LCFS/RFS credit value is split amongst the entire feedstock supply chain
- Site, gas producer, pipeline operator, credit traders, H2 producer, station operator, customer
The Challenges of Biogas II

Limited impact of EAs
- LCFS does not allow for application to “process energy” - only feedstocks
  - EAs only for the fraction of RNG converted to H2
  - No EAs for NG reactor heating (25%), compression, liquefaction

Another Challenge

CARB pathway process can be complex
- A single site can require dozens of pathways
  - Combinations of feedstocks and energy usage
  - Multiple supply schemes
- Pathways are determined by and require plant operating data
  - Essentially no credits until performance is established
  - 90 days operation required
  - Plant startups can be very challenging and likely don’t have good operational data early on

CARB has been exceptionally accommodating as we go through this for the first major plant