

ION Engineering

UAEA Briefing

June 29, 2017

Alfred “Buz” Brown, CEO & Chairman

Overview of ION Engineering, LLC

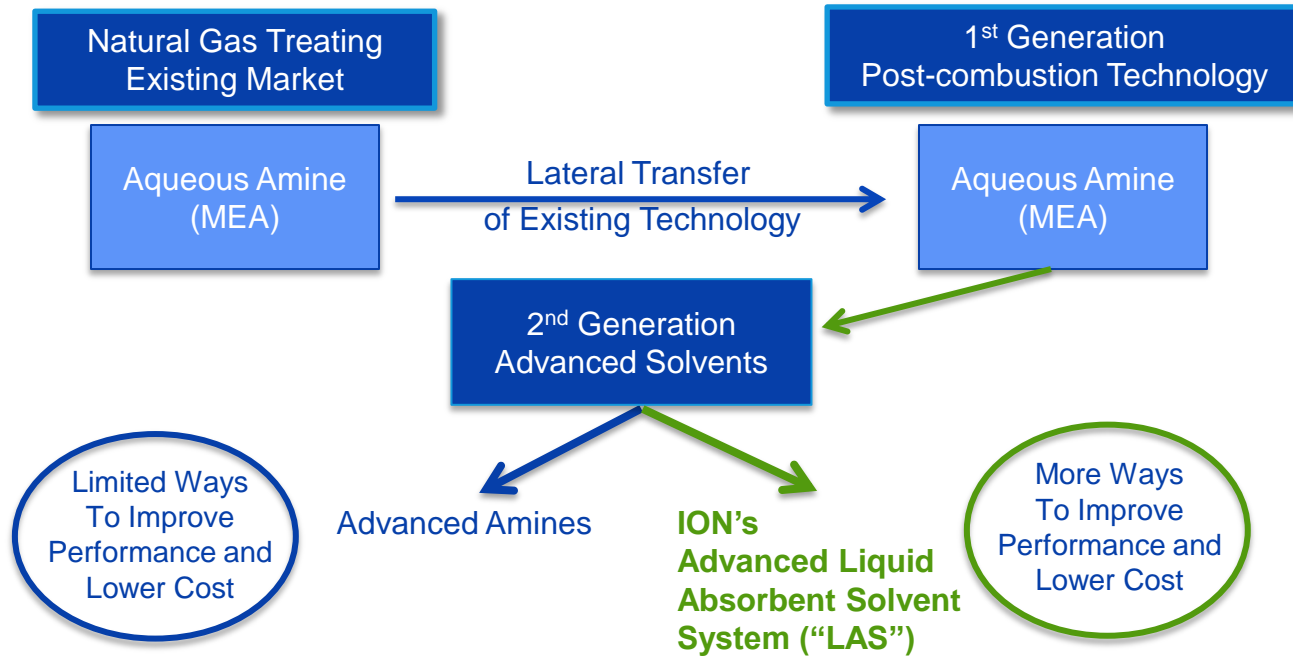


- Location: Boulder, Colorado
- Mission: Decarbonize Fossil Fuel Emissions
- Technology:
 - Solvent System
 - Analytics
 - Mass Transfer/Heat Exchange
- Major Funding Sources
 - DOE Carbon Capture Program
 - CO₂ Capture Project
 - Colorado OEDIT
 - CLIMIT & TCM



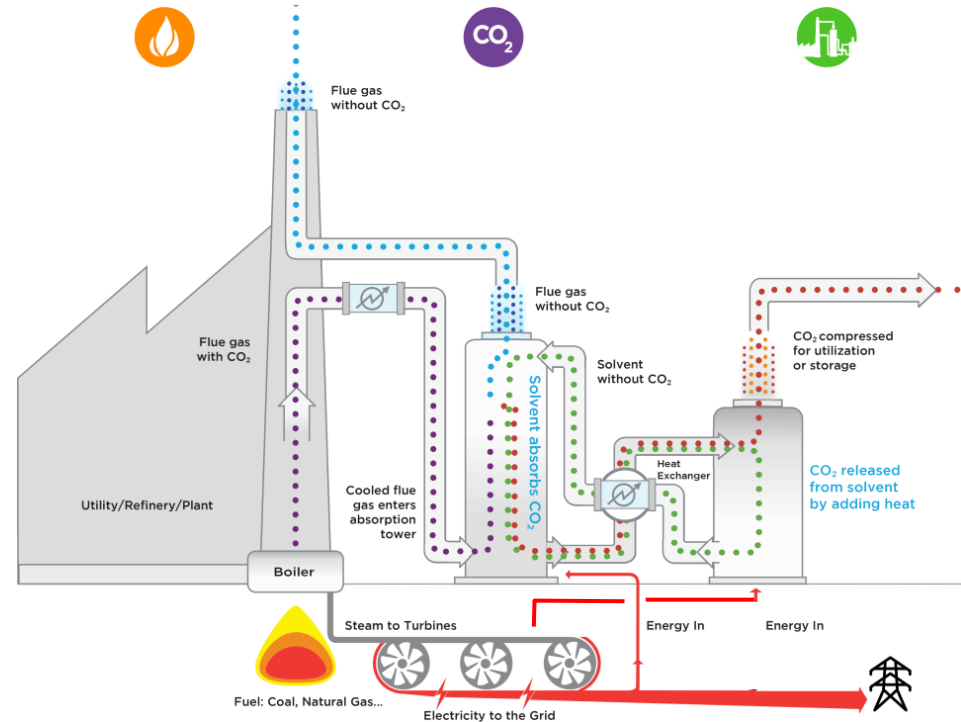
Advanced Liquid Absorbent System

ION has developed and patented an advanced liquid absorbent technology that is more efficient & a lower cost CO₂ capture system vs. traditional methodologies



Advanced Liquid Absorbent System (“ALAS”)

- **Basis of Performance**
 - < 1,090 Btu/lbCO₂ captured (2.5 MJ/kg)
 - Fast kinetics
 - Working capacity
 - Low heat capacity
 - Low corrosion
- **Reduces CAPEX**
 - Smaller Columns, HXs and footprint
- **Reduces OPEX**
 - Lower energy requirements
 - Less solvent make-up
 - Lower emissions
- **Lower Parasitic Load**
- **Scalability**
 - Established engineering process



Development Fast Track

ION is developing its technology by leveraging existing research facilities with several global and local partners utilizing DOE performance targets as minimum criteria

- More than a dozen partners have provided > \$38M (2010 – 2017)
- ION is expanding relationships internationally



- \$4M Proof of Concept
- 0.05 MWe Pilot (in-house)
- Began Q1 2010; Completed 2012



- \$2M Proof of Principle (at EERC)
- 0.25 MWe Coal & NGCC - Fired Pilot
- Completed 2013



- \$10M Pilot Project (at NCCC)
- 0.5 MWe Coal - Fired Pilot
- Completed 2016



- \$15M Demonstration Project (at TCM)
- 12 MWe Pilot Demonstration
- Q4 2016 to Q2 2017

ION's Development Progress

Univ. of North Dakota EERC Campaign



National Carbon Capture Center Campaign





CO₂
Technology
Centre
Mongstad

12MWe

80 km north of
Bergen, Norway

Statoil Refinery
Site

ION's Development Progress (continued)



RD&D Path to Commercialization



2012

Univ. of N. Dakota
EERC
0.25 MWe
United States



2015

National Carbon
Capture Center
0.5 MWe
Wilsonville, AL, USA



2016 - 2017

CO₂ Technology
Centre Mongstad
12 MWe
Mongstad, Norway

Possibly Not

NETL Carbon
Capture
Program:
Large Scale
Pilot
~ \$60M

2018 - 2022

Design/Build Large
Scale Pilot Unit
25 MWe
United States

Most Definitely Not

NETL Carbon
Capture Program:
Major
Demonstration
Program
~ \$250M

2022 - 2026

1st Commercial
Deployment
125+ MWe
United States

FY 2018 Congressional Budget Justification

Fossil Energy



Carbon Capture: The Request provides \$16 million to focus on lab research and bench-scale development of transformational carbon capture technologies ...

Transformational capture systems are considered to be a set of disruptive technologies that can significantly reduce the cost of capture, targeting a cost of electricity at least 30% less than state-of-the-art (~\$30/tonne).

While the Carbon Capture subprogram has previously focused on 1st generation separation technology demonstrations and 2nd generation pilots, these large, more mature efforts are no longer central to the R&D portfolio.

In FY 2018, the program discontinues funding for large-scale demonstrations, pilot projects and similar projects addressing technology scale-up as industry is capable of advancing these technologies to commercial deployment.

Thank You

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