

ARCTIC 4 Natural Gas Decarbonization

September 2017 - March 2019

Challenge:

Reduce or remove carbon from natural gas - which is used in oil sands operations as a fuel source for power generation, heating applications, and as a hydrogen source for bitumen upgrading - prior to combustion, to provide:

- Combustion fuel with lower GHG intensity compared to natural gas
- Carbon-rich or black (>97% elemental carbon) by-product

Challenge Sponsor: COSIA

Challenge Facilitators: Delphi Group and Tessellate

Budget: \$500,000

Finalist: None (Paused at evaluation stage)

Semi-Finalists:

Standing Wave Reformers, Shock Wave Fuel Reformer:

- A device that removes carbon from natural gas through methane thermal cracking

ETCH:

- Uses a "non-catalytic" NiCl₂ based cycle to produce hydrogen and carbon
- Submitted a patented heat recovery system that condenses exhaust gas

Clean Carbon Energy:

- Process uses heat exchangers to generate hydrogen and carbon by making an established process "continuous" instead of batch

Environmental Benefits:



Reduction of GHG
from Alberta Oil Sands



Eliminated Need
for flue gas stack carbon capture

Outcomes:

Researchers for Standing Wave Reformers conducted a series of tests on methane thermal cracking on-board a wave rotor.

Researchers for ETCH explored how to scale the chemistry and optimize the technology at larger scales.

Researchers for Clean Carbon Energy worked to determine optimal heat exchange configuration by testing Si-C or Alloy Steel.

Conclusion:

This challenge concluded without a clear finalist, however the lessons learned about the processes to remove carbon from natural gas were substantial. Both R&D and commercialization projects are continuing based on this work, and Suncor (the challenge industry partner) expressed interest in the Wave Reformer technology and has since taken the project in-house.

