Natural Gas Decarbonization Challenge
Application Deadline: Jan 15, 2018 11:59 PM PT

Q&A Webinar Date: Dec 13, 2017, 9 PT/10 MT/12 ET
Overview

- Presentation Objectives
- General Background Information
- Roles
- The Challenge

ARCTIC COSIA Natural Gas Decarbonization Challenge
Presentation Objectives

- Provide important background information about ARCTIC and this Challenge
- Discuss opportunities and roles for Innovators and Innovation Ecosystem Partners to engage in this ARCTIC Challenge
- Facilitate an upcoming Q&A related to the program and this Challenge

ARCTIC COSIA Natural Gas Decarbonization Challenge
General Background Information
About Foresight

- Started in 2013 as Western Canada’s first Cleantech Accelerator currently supporting 25 companies

- A Not-for-Profit with Funding from BC Innovation Council and Western Economic Diversification

Services

- BCIC Venture Accelerator Program
- Expert Clinics and Cleantech Connect Events
- Office and Lab Space
- ARCTIC Program

ARCTIC COSIA Natural Gas Decarbonization Challenge
About ARCTIC

Advanced Resource Clean Technology Innovation Centre:
Meeting Market Needs by Linking Innovators to Real Challenges

- Energy
- Forestry
- Mining

ARCTIC COSIA Natural Gas Decarbonization Challenge
ARCTIC: The Process

**Phase 1 - Industry Consultation**
- Innovation Challenge Defined

**Phase 2 - Innovator Selection**
- 2-5 innovators selected

**Phase 3 - Innovation Sprint**
- 2-5 prototypes developed

**Phase 4 - Field Trials**
- Prototype Tested by Industry

**Commercialization Process**
- Proven Products move to market

**Industry Consultation**
- Dialogues will be hosted to identify pressing industry challenges that need advanced technology innovations
- A broad group of industry and clean tech innovators will be reached
- 2-5 groups will be selected by a jury of industry, investors, and experts for each 6-month spring

**Innovation Sprint**
- The 2-5 firms for each sprint will receive funding support to develop a prototype within 6 months
- Mentorship and business support will be provided by Foresight to help accelerate an idea from concept to prototype and from seed to first funding

**Field Trials Commercialization**
- The industry sponsor will select at least one prototype for field testing
- Foresight will provide project management oversight, an Executive-In-Residence, lab and office space, and business support to help the company towards commercialization

ARCTIC COSIA Natural Gas Decarbonization Challenge
Roles
Role: Foresight

- Program Management
- Challenge Definition Support through consulting teams
- Challenge Marketing and Innovation Selection Process
- Project Support through mentorship, training, lab space
- Partnership Development to improve opportunities for innovators and engage other support in the innovation system

ARCTIC COSIA Natural Gas Decarbonization Challenge
Role: Industry Sponsor

Phase 1 – Collaborate to Select and Define Challenge
Phase 2 – Assist in Innovator Selection
Phase 3 – Review/Advise Innovators
Phase 4 – Select Innovator, Conduct Trial

Provide:
• 35% of the project budget
• Technical expertise in Challenge Area

Receive:
• Leveraged funding partner
• Access to novel solution providers
• Access to top-graded opportunities
• Potential supply chain collaborators
Role: Innovation Ecosystem

- **Share**
  - Distribute the information about the ARCTIC Challenges to your network

- **Refer**
  - Recommend to innovators in your network to engage in the application process

- **Mentor**
  - Assist companies in your markets who are participating in the program to increase opportunities for success

- **Leverage**
  - Identify and bring other funding or in-kind to the table for the innovator to prepare them for success
  - Volunteer as an expert to top-grade innovators for your programs, for investor and industry success
Role: Innovators

Phase 2 –
• Application process

Phase 3 –
• Refine Technology for Field Trial Opportunity by meeting technical requirements and proving scaling opportunity

Phase 4 –
• Collaborate with Industry on Field Trial Opportunity

Receive
• up to $500,000 (cash)
• Access to real market opportunities and expertise to reduce risk
• Leverage current funding and attract new sources of funding

Provide In kind contributions of:
$50,000 in Phase 3 if selected
$100,000 in Phase 4 if selected

ARCTIC COSIA Natural Gas Decarbonization Challenge
The Natural Gas Decarbonization Challenge
About COSIA

- **Our Vision** is to enable responsible and sustainable growth of Canada’s oil sands while delivering accelerated improvement in environmental performance through collaborative action and innovation.
Key Challenge

- Natural gas is used in oil sands operations as a fuel source for power generation, heating applications, and hydrogen source for bitumen upgrading. COSIA is seeking solutions that can reduce (or remove) carbon from natural gas to provide:
  1) a carbon-lean (or depleted) combustion fuel with a lower greenhouse gas ("GHG") intensity compared to natural gas; and,
  2) a valuable carbon-rich or carbon black by-product.

- This by-product will provide economic and environmental value to users of the solution. Solutions must reduce overall GHG emissions reductions compared to the current natural gas combustion approach.
NGD Overview

- 700,000,000 GJ combusted per year (heat 7,000,000 average sized homes)
- 2/3 of oil sands GHG emissions occur from natural gas combustion

A) Simplified process diagram for natural gas use in oil sands facilities

B) Simplified process diagram for Natural Gas Decarbonization Technology for the Challenge

ARCTIC COSIA Natural Gas Decarbonization Challenge
Potential NGD Schemes

- Representative, but NOT an exhaustive list of potential solutions
- Carbon lean fuel produced must be compatible with existing burners

ARCTIC COSIA Natural Gas Decarbonization Challenge
Key Performance Indicators

GHG Emissions
- Must be lower overall
- Cannot shift emissions burden downstream
- Calculation needed to support value

Solution Process
- Equipment needed; consumables; anticipated energy use; process continuity; maintenance expectations; equipment lifetime; technology life

Carbon By-product
- Valuable carbon by-product
- Environmental, economic, and ancillary benefits

ARCTIC COSIA Natural Gas Decarbonization Challenge
Key Performance Indicators

Material and Energy Balance
- Need to show that energy and material inputs and outputs balance
- Simplified process flow diagram

Business and Technology Readiness
- Solutions at any TRL level can apply

Team and Development Plan
- Project team members, role, experience
- Plan to develop solution into commercial technology

ARCTIC COSIA Natural Gas Decarbonization Challenge
Successful Solutions...

Will:

- Produce a combustible carbon-lean fuel, and
- Produce a carbon-rich by product:
  - Preference will be given for by-products that can be used/sequestered on site (e.g. diesel, diluent, flocculants, alkanes, cycloalkanes, aromatics, solvents, carbon black, etc.), and
- Reduce overall GHG emissions compared to natural gas combustion, and
- Describe a path to commercial viability
Successful Solutions...

Not in Scope

- Solar technologies for hydrogen production
- Geothermal technologies
- Other renewable/bio energy sources
- Pre- and post-combustion gas phase carbon capture
- Biofuels, biogas, biomass utilization
- Direct oxidation of natural gas with oxygen to produce water
## Challenge Assistance

<table>
<thead>
<tr>
<th>Phase</th>
<th>Participants</th>
<th>Funding</th>
<th>Candidate In Kind (minimum)</th>
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<tbody>
<tr>
<td>Phase 3 – Sprint</td>
<td>2-5</td>
<td>Up to $500,000</td>
<td>$50,000</td>
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<tr>
<td>Phase 4 – Field Trial</td>
<td>1-2</td>
<td></td>
<td>$100,000</td>
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Evaluation Criteria

- Will be based on KPI’s

- Will reflect broad TRL levels and company maturity
# Challenge Timelines

<table>
<thead>
<tr>
<th>Action</th>
<th>By Whom</th>
<th>Dates</th>
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<tbody>
<tr>
<td>Potential applicants/innovators and innovation partners program briefing webinar</td>
<td>ARCTIC</td>
<td>Dec 13, 2017</td>
</tr>
<tr>
<td>Proposal Submission Deadline</td>
<td>Proponents</td>
<td>Jan 15, 2018</td>
</tr>
<tr>
<td>Shortlisted proponents contacted for presentations</td>
<td>ARCTIC Review Team</td>
<td>Jan 30, 2018</td>
</tr>
<tr>
<td>Final Sprint Decisions and Start Sprint (prototype or test, or equivalent)</td>
<td>Proponents and ARCTIC/COSIA</td>
<td>March 7, 2018</td>
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<tr>
<td>Wrap up Sprint, choose Field trial winner</td>
<td>Proponents and ARCTIC/COSIA</td>
<td>September 7, 2018</td>
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Application Details at [arctic.foresight.com](http://arctic.foresight.com)
For More Information

Program & General Questions

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Technical Questions

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