

Mobilizing the world's minds and resources to improve environmental performance.



Natural Gas Decarbonization

SOLUTION DESCRIPTION: Technologies that will partially or completely remove the carbon content of natural gas	INNOVATION OPPORTUNITY CHAMPION: COSIA's GHG EPA is championing this Innovation Opportunity. Our aspiration is to produce our oil with lower greenhouse gas emissions than other sources of oil.
CREATED: March 2022 All project proposals are evaluated and actioned as they are received.	
<p>For more information on this COSIA Innovation Opportunity please visit</p> <p>www.cosia.ca/innovation-opportunities/greenhouse-gases</p>	

SUBMIT YOUR IDEA [HERE](#)

Canada's Oil Sands Innovation Alliance (COSIA) accelerates the pace of environmental performance improvement in Canada's oil sands through collaborative action and innovation. COSIA Members represent more than 90 per cent of oil sands production. We bring together innovators and leading thinkers from industry, government, academia and the wider public to identify and advance new transformative technologies. Innovation Opportunities are one way we articulate an actionable innovation need, bringing global innovation capacity to bear on global environmental challenges.



NATURAL GAS DECARBONIZATION

WHAT TO SUBMIT TO COSIA

COSIA requires sufficient non-confidential, nonproprietary information to properly evaluate the technology. Some items that will be especially important to present in your submission are:

- Concept and basic unit operations
- Technical justification for the approach (e.g. laboratory batch or continuous experiments; pilot or demo plants; process modeling; literature precedent)
- Describe quantities and qualities of utilities and consumables that are required
- Energy inputs – quantity and type(s)
- Capital and operating cost estimates if available based on described capacity targets
- 3rd party verified comparison of your proposed technology against an MEA baseline. 3rd party verifiers should be reputable, independent engineering companies if possible
- Basis of cost estimation, including estimation scope, contingency, etc.
- IP status of your proposed technology
- What operating environment restrictions might your technology face:
 - Explosive atmospheres
 - Severe weather
 - Power fluctuations

FUNDING, FINANCIALS, AND INTELLECTUAL PROPERTY

COSIA Members are committed to identifying emerging technologies, while protecting the Intellectual Property (IP) rights of the owner of the technology.

HOW TO SUBMIT TO COSIA

Submit a summary of your solution using COSIA's Environmental Technology Assessment Portal (ETAP) Process, available at:

<https://cosia.ca/focus-areas/e-tap>

Please note: ETAP is a staged submission process. The initial submission requires only a brief description and limited technical information. Upon review by COSIA, additional information may be requested. Instructions for submission are provided on the ETAP site.

All information provided is non-confidential. COSIA will respond to all submissions.

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DETAILED SOLUTION DESCRIPTION

The COSIA GHG Environmental Priority Area (EPA) Steering Committee (SC) has identified natural gas decarbonization as an opportunity area in which to explore for technologies that will materially reduce oil sands GHG emissions. These technologies will partially or completely remove the carbon content of natural gas. The emissions associated with producing the decarbonized gas, plus the emissions from combusting the decarbonized gas, will be less than the emissions from combusting natural gas.

Evaluation metrics include GHG emission intensity and CO₂ avoidance cost. GHG intensity will include any change in combustion efficiency that may result from the decarbonized gas. The second metric will account for the costs required to achieve GHG reduction including CO₂ or carbon sequestration.

The ideal technology will:

- Reduce the GHG emission intensity of the altered gas in steam generation including the energy used in decarbonizing the gas
- Remove the carbon and transform it into a form that is sequestration ready, e.g., such as carbon black

BACKGROUND

A common bitumen production process involves the injection of steam into the bitumen reservoir. The steam heats the bitumen 'in situ', meaning in place, reducing the viscosity of the bitumen such that it can be pumped to surface facilities for further processing.

In Situ Oil Sands operations consume large quantities of natural gas to produce steam. A typical 33,000 BPD facility would operate six steam boilers requiring 1600 GJ/h (LHV) of natural gas. Combustion air is supplied at 55°C, using natural or forced draft. Combustion flue gas contains 7-8% CO₂.

Material and energy flow diagrams for a standard 33,000 BPD in-situ facility are provided below.

COSIA is investigating a number of carbon capture technologies, including post-combustion CO₂ capture and pre-combustion CO₂ capture, and oxy-combustion. High capital and operating costs have hindered the deployment of these technologies.

NATURAL GAS DECARBONIZATION

An alternative capture technology is to remove the carbon from natural gas before combustion, through thermal or electrical means. The former is the basis of carbon black manufacturing while the latter includes using plasma to decarbonize the gas. In both cases, the carbon is removed as solids, which is sequestration ready, while the remaining gas has a higher hydrogen content.

The energy used to decarbonize the gas plus the subsequent combustion efficiency change must be included in the GHG emission accounting. This metric could be measured per unit steam generated. The avoidance cost of decarbonizing natural gas would be compared against existing carbon capture approaches (pre- and post-combustion, oxy-combustion)

APPROACHES NOT OF INTEREST

Natural gas gasification or reforming to make syngas

ADDITIONAL INFORMATION

COSIA has several tools you can use, including sample Reference Facilities. These tools will help you analyze and quantify the benefits of your technologies prior to submitting them to our [Environmental Technology Assessment Portal \(ETAP\)](#). You can find these tools on the Green House Gases Innovation Opportunity page at [Greenhouse Gases Innovation Opportunities | Canada's Oil Sands Innovation Alliance - COSIA](#).

For this specific Innovation Opportunity, please review the tools noted below:

SAGD Reference Facility

- Base Case, mechanical lift, Warm Lime Softening CPF **pg 43/60**
- Base Case WLS/OTSG Energy Flow **pg 45/60**

Mine Reference Facility

- High Grade PFT (Mass and) Energy Flow **pg 23/26**
- High Grade NFT (Mass and) Energy Flow **pg 25/26**