

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



Alternative Silica Removal Technologies

<p>SOLUTION DESCRIPTION:</p> <p>We are seeking solutions/technologies to remove dissolved Silica from treated produced water in Oil Sands Insitu facilities.</p> <p>(Steam Assisted Gravity Drainage (SAGD), and Cyclical Steam Stimulation(CSS)</p>	<p>INNOVATION OPPORTUNITY CHAMPION:</p> <p>COSIA's Water EPA is championing this Innovation Opportunity.</p> <p>Our aspiration is to reduce water use and increase water recycling rates at oil sands mining and in situ (in place) operations without environmental burden shifting</p> <p>COSIA has four Environmental Priority Areas (EPAs): Water, Land, Tailings, and Greenhouse Gases (GHGs).</p>
<p>CREATED: (Insert date of update)</p> <p>All project proposals are evaluated and actioned as they are received.</p>	
<p>For more information on this COSIA Innovation Opportunity please visit</p> <p>www.cosia.ca/innovation-opportunities</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.



#0004: ALTERNATIVE SILICA REMOVAL TECHNOLOGIES

WHAT TO SUBMIT TO COSIA

COSIA requires sufficient non-confidential, non-proprietary 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 verification of your proposed technology. 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 and funding the development of the technologies to the point of commercialization, while protecting the Intellectual Property (IP) rights of the owner of the technology.

Successful proposals can receive funding from COSIA members to develop and demonstrate the technology in an oil sands application. Multiple technologies may be funded, at the discretion of the Members.

HOW TO SUBMIT TO COSIA

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

<http://www.cosia.ca/initiatives/etap/idea-submission-form>

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 Water Environmental Priority Area Steering Committee, and Water Treatment Working Group invites proposals for silica removal technologies to remove silica from Steam Assisted Gravity Drainage (SAGD), and Cyclical Steam Stimulation (CSS) produced water to improve the environmental performance of the oil sands. The proposed solution can remove only silica or silica and hardness. Proposals based on work that is a proven concept are desired.

The successful technology will:

- Meet the water quality specification below
- SiO₂ <50 mg/L (minimum), <25 mg/L desirable
- Operate at > 85°C, >135°C desirable
- Be scalable to 15,000 to 20,000 m³/day

The following characteristics are desirable

- Minimal chemical sludge;
- Minimized reaction times to minimize reactor footprint;
- Removes TOC;
- Low energy;
- Applicable across a broad concentration range
- Modular
- Robust

Process application design basis:

- Volumetric flow rate 15,000 to 30,000 m³/d
- Heavy industrial boiler feed water application (once through steam generators)

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BACKGROUND

The most common recovery process employed for producing oil from deep oil sands reservoirs (geological formations), is known as Steam Assisted Gravity Drainage (SAGD). In this process, steam is generated at a Central Processing Facility (CPF), transported to well pads, and injected into a horizontal well bore within the formation. The heat supplied by the steam warms the heavy oil in the reservoir, allowing it to flow via gravity into a second well bore that captures the oil water mixture and produces it to the surface with the hydrocarbon at temperatures of over 180°C, and high levels of impurities, including salts, metals, silica and organic compounds (see water quality data below). Because of the large water requirements recycling and reuse of the produced water recovered is mandatory both to protect the environment and to minimize costs.

The produced oil water is treated to purity where it can be recycled to the steam generators. Produced water treatment includes; oil treatment and de-oiling which separates the bulk of the oil and water, and water treatment which removed silica, hardness, and additional impurities

Current silica removal processes in industrial water treatment rely heavily on:

- Lime-softening style silica precipitation, which has a large footprint, creates large volumes of sludge, is difficult to operate and subject to upsets, and has a high capital cost; and
- Evaporation which is smaller, but more energy intensive with higher operational cost .

Produced water characteristics:

- TDS 500-10,000 mg/L
- pH 6-9
- SiO₂ 100-350 mg/L, Ca 5-150 mg/L, Mg 5-75 mg/L, TOC 200-600 mg/L, TIC <100 mg/L

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APPROACHES NOT OF INTEREST

The following approaches are not of interest:

- Approaches that have not demonstrated proof of concept
- Tube coatings, or tube configurations
- Low quality steam generation
- Configurations that produce steam that is co-mingled with other products (such as the products of combustion from the boiler, or nitrogen)

ADDITIONAL INFORMATION

Supplemental Information – Typical SAGD Material and Energy Balance