

METHANOLITE

Presented By: ENOVA Calgary



INTRODUCTION

In an oil and gas industry that contributes to the destructive cycle of pollution through methane emissions, looking at nature's solution within microorganisms provides a promising alternative: ***recycling methane to the useful byproduct of methanol.***



THE PROBLEM

Methane is a potent greenhouse gas with about 30 times the global warming potential of carbon dioxide. In mitigating methane emissions, we must address the challenge of how two-thirds of this greenhouse gases is introduced in the atmosphere– through processes like venting and the flaring in Oil and Gas operations. Efforts to curtail these problems are persevering to make headway. Currently, the Government of Canada has committed to reducing methane emissions from the oil and gas sector by 40% to 45% from 2012 levels by 2025

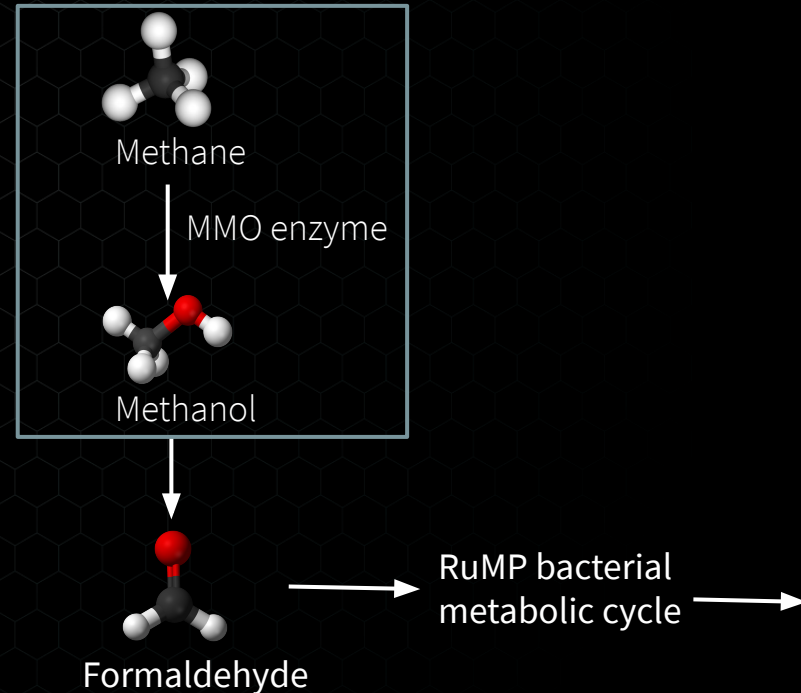
INSPIRATION FROM LIVING SYSTEMS

in mitigating methane emissions

A methanotroph is a bacterium that digests methane in its metabolism

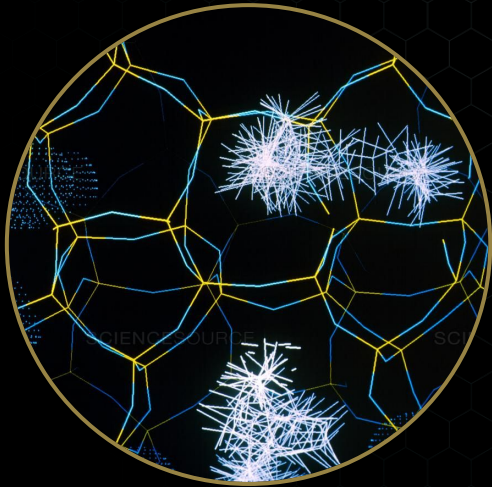
Its metabolism can be blocked at select points once a useful byproduct, such as methanol, is reached

Methane can be oxidized to produce methanol by the MMO (methane Monooxygenase) enzyme that is required for bacterial survival



BIOMIMICRY SOLUTION

Biomimicry is heavily leveraged in the Methanolite system. We take direct inspiration from Methanotrophs in designing our conversion process from methane to methanol by making use of copper zeolite catalysts. The specific function of the methanotroph being emulated is the catalysis performed by the MMO enzyme.



Pictured Left:
A Methane Diffused
Zeolite Catalyst





Value Proposition

We help companies in the oil and gas sector repurpose methane to methanol, a useful product that is used in the production of paints, furniture, and electronics among others.

MARKET SIZE

Companies that have contributed the most to methane flaring in Alberta

Canadian Natural Resources Ltd., Husky Oil Operations Ltd., Syncrude, Devon, Suncor Energy Inc., Twin Butte Energy Ltd., Cenovus, Penn West Petroleum Ltd., Gear Energy Ltd., Cardinal Energy Ltd.

\$250
Million

The amount of leaked and vented methane over *one year* has the market value between \$213 – \$253 million, as reported by Carleton University research

The Pembina Institute reports that, if Alberta's \$30 per tonne carbon tax is applied to methane emissions, the government may collect \$1.1–\$1.4 billion from this refuse gas.

Reports on methane leaks are likely to be 25-50% lower than actual values, as predicted by Carleton University Researchers

25-50%

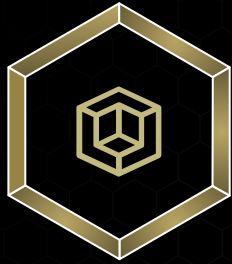
5%

163k

The global demand for methanol is growing at a rate of 5% annually.

The province of Alberta alone has over 162,500 active wells this year. Infrared cameras, electric controllers, and predictive software models have emerged to track methane leaks, but we have yet to implement solutions for repurposing the gas.

COMPETITORS



TRL: Level 9

SynGas Conversion

Highly Exothermic
Large amount of Energy Required
Production of CO₂



TRL: Level 3

Alternate Catalysts

Relatively new technology
Still being researched



TRL: Level 2

Azeotropic Ethanol

Possible replacement for methanol
Greener Product
Not universally replaceable



COMPETITIVE ADVANTAGE

THEM

Competitors in Alberta heavily rely on the oil and gas sector to pursue a strong and prosperous economy. Additionally, the Canadian methanol industry is reliant on syngas for the production of methanol, and both these factors subsequently lead to high greenhouse gas emissions.

US

With the addition of Methanolite to the Albertan market, we can reduce methane emissions produced by the energy sector while furthering the profit made by these corporations, all by converting their methane sinks into a viable product with a lower energy requirement.

BUSINESS MODEL



Acquiring Customers . . .

In the coming months, we hope to develop our connections with the Canadian Gas Association (CGA) in order to expand our customer base. The companies of CGA are involved with distribution and equipment manufacturing among others.



Providing Our Service . . .

Our group will work closely with companies, assess their data on methane emissions, modify our system to fit their needs, and finally provide the system through a license.



Making Revenue . . .

By selling our services through a licence revenue model, our group will be able to reach a considerably large Total Available Market.



PROTOTYPING JOURNEY



Initial Catalytic Bed Design

Creating the System

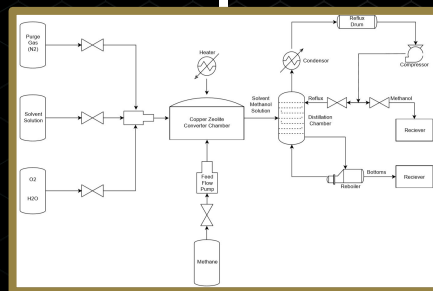
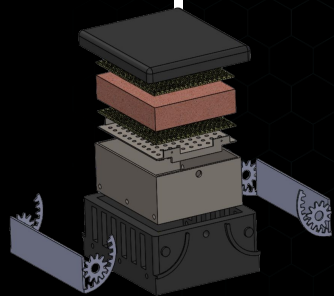
Process Flow Calculations
& Catalytic Bed Revision

Dec 2019

Mar 2020

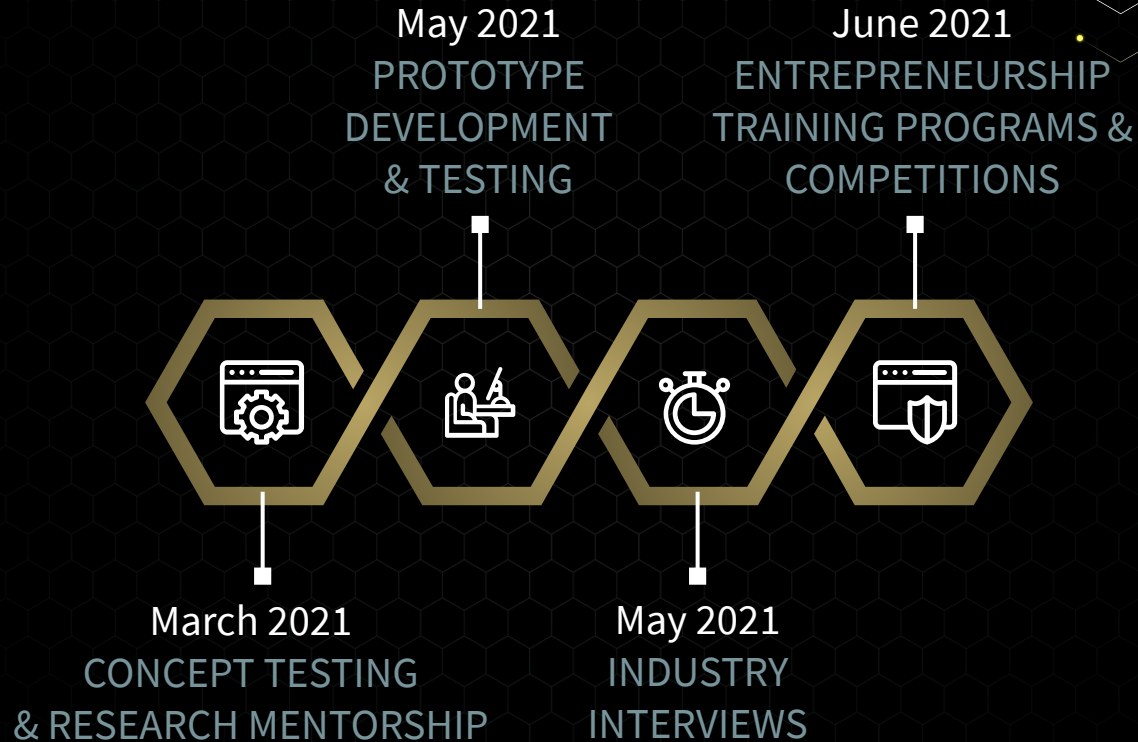
Oct 2020

2021



Physical Prototyping

FUTURE PLANS



KEY ASSUMPTIONS BEING ADDRESSED



>> Catalytic kinetics and efficiency factor:

- ❑ Testing catalyst lifespan and reusability
- ❑ Testing reactants and their effect on the rate of reaction
- ❑ Finalizing reaction conversions

>> Revenue model:

- ❑ Developing a customer base
- ❑ Performing Implementation & Cost analysis



OUR ASK

We would like to seek mentorship from, or explore partnership with, industry experts from the following fields:

- >> Process flow design and catalytic reactors
- >> Catalytic chemistry for testing
- >> Methanotrophic Biology & Biomimicry In Engineering Design
- >> Oil and gas industry connections to test assumptions and get a better feel of the field



ENOVA CALGARY

Emulating Nature in Innovations (ENOVA) is a University of Calgary club that brings together students from interdisciplinary backgrounds to devise clever solutions to a breadth of contemporary challenges by seeking inspiration from nature and its elegant, well-honed creations. We compete in international design competitions, and promote biomimicry through activity-based and skill-building workshops.

CONTACT

Please reach out to us at enovacalgary@gmail.com



OUR TEAM



Agam Aulakh

[she/her]
Software & PR Design



Cheshta Sharma

[she/her]
Chemical Reaction Design



Anjali Patadia

[she/her]
Process Design



Naureen Othi

[she/her]
Biological Considerations
& Outreach



Appendix



In search of more information on climate change (1), methane market value (2), or the methanol industry (3)? Please visit to the references below:

1 Baumann, F. The systemic challenge of global heating. *Int Polit Rev* 6, 134–144 (2018).
<https://doi.org/10.1057/s41312-018-0065-5>

2 ENVIRONMENTAL DEFENCE CANADA. (2017). "Canada's Methane Gas Problem: Why strong regulations can reduce pollution, protect health, and save money." Online at:
<https://www.mgc.co.jp/eng/rd/technology/methanol.html>

3 MITSUBISHI GAS CHEMICAL. (n.d.). "The Many Uses of Methanol." Online at:
<https://www.mgc.co.jp/eng/rd/technology/methanol.html>

2 Pembina Institute. (2018). "Estimate of lost natural gas sales, royalty, and carbon levy from methane releases in the Alberta oil and gas sector." Online at:
<https://www.pembina.org/reports/briefing-methane-lost-value.pdf>