ALBERTA INNOVATES

CLEAN RESOURCES

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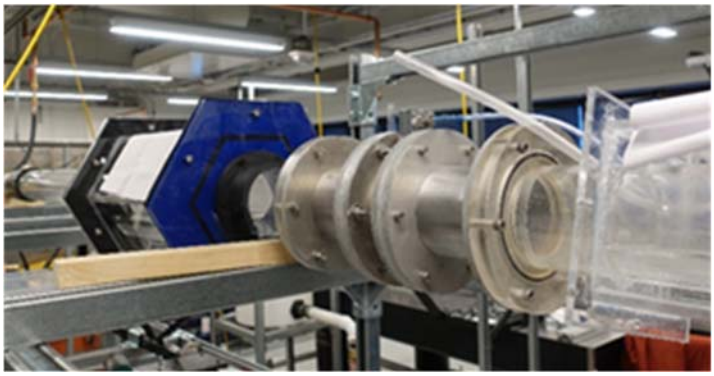
CLEANER HYDROCARBON PRODUCTION – RECOVERY TECHNOLOGIES

Ongoing Monitoring of Steam Quality with Microwave Technologies

Steam is an essential part of SAGD, which involves producing steam, transporting the steam to wellheads and injecting the steam underground such that the heat transferred to the formation decreases the viscosity of the bitumen. Optimizing the steam quality increases energy efficiency and reduces waste water. While various approaches to assessing steam quality have been proposed, there remains a need for a continuous, fast and reliable measurement of steam quality that can be implemented at various locations from boiler to well-head. This project aims to develop a robust approach to steam quality monitoring using microwave sensing techniques.



View of the sensor (silver section) in the test system. The acrylic boxes are part of a second system used to characterize the flow in the pipes.

FUNDING DETAILS

RECIPIENT:
University of Calgary

PARTNERS:
Cenovus Energy

TOTAL BUDGET:
$100,000

AI FUNDING:
$50,000

PROJECT DATES:
NOV 2018 – NOV 2019

PROJECT TRL:
Start: 3
End: 6

APPLICATION

The sensor is designed to assist in optimizing SAGD operations. In the steam generator, a liquid phase is typically present to reduce deposition of dissolved solids, resulting from operation at lower steam qualities. While it is recognized that operating at higher steam qualities may have advantages, implementation is limited by lack of accurate feedback. This sensing technology may enable better estimation of dry out conditions in the pipes, maximize steam production, and reduce unnecessary downtime.

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PROJECT GOALS

The key goals of the project are…

- Developing a simulation environment that depicts flow in pipes and allows for exploration of sensing strategies. This includes simulations of liquid and gas (steam) traveling in pipes with different geometries, as well as simulations of the interaction of microwave signals with these different distributions of liquid and gas.
- Implementing and testing sensing approaches in a lab-based environment. This involves matching simulations with measurements, and developing a series of increasingly complex tests to demonstrate the feasibility and robustness of the approach.
- Demonstrating the potential of microwave sensing approaches to assess steam quality with 1% accuracy. In addition to lab-based tests with controlled flows, this involves incorporating sensors into a test environment that supports more complex flows. Simulations are also used to explore extension to realistic operating conditions.

BENEFITS TO ALBERTA

The successful implementation of this technology or use of the knowledge generated could result in:

- Reductions in green house gas emissions, long term, through optimizing steam quality in SAGD processes. Increased steam quality implies a reduction in water blow down. This reduction is expected to result in a decrease in GHG emissions.
- Partnerships between researchers at the university, as well as between the university and industry, to support further development of the technology, as expertise from multiple disciplines is required to design and implement the technology, as well as test in realistic operating conditions. Longer term research projects result in training opportunities for students, postdoctoral fellows and research engineers.
- Opportunities for technology transfer and commercialization of the unique aspects of the sensing approach.

3 Students Trained

1 New Product

3 Future Jobs

25-50 kT/yr Future GHGs Reduced

CURRENT STATUS

MAR 2020

This project is now complete. The principal research team is continuing to investigate this technology in their lab and with their industrial partner, Cenovus Energy. The final report will be available to the public in May 2020.