

Development of advanced prototype of novel Gas Slug Handling System for ESPs in high GVF SAGD

OAKS-HILL Engineering is developing a novel Gas Slug Handling System (GSHS), a cost-effective system designed to mitigate the impact of gas slugs—often intensified by non-condensable gas (NCG) injection and undulating well trajectories—that negatively affect Electric Submersible Pump (ESP) performance in SAGD operations. The GSHS improves ESP system reliability, reduces energy consumption, and minimizes production downtime. The feasibility of this technology has been validated through visualization testing and preliminary engineering analysis. By reducing inefficiencies in gas handling, the system enables up to a 22% reduction in GHG emissions from ESPs with clear operational and environmental benefits.



RECIPIENT:
**OAKS-HILL
Engineering**



PARTNERS:
**Plainsman
Manufacturing**



TOTAL BUDGET:
\$140,000



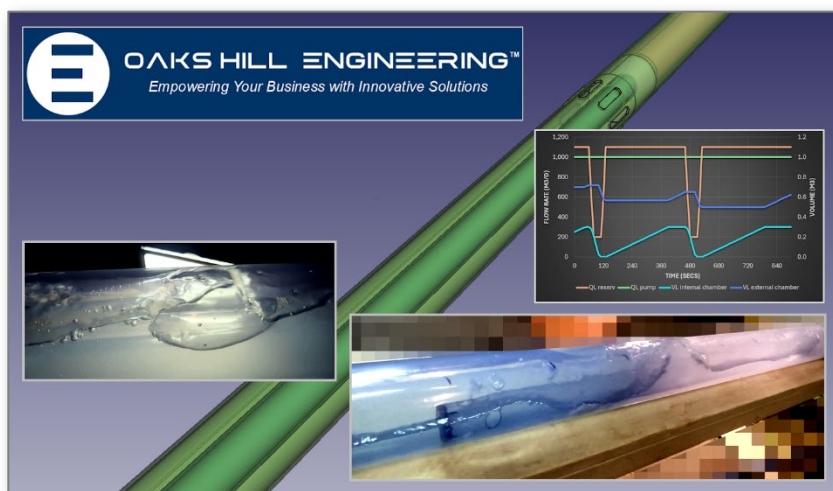
AI FUNDING:
\$70,000



PROJECT DATES:
**APR 2025 –
DEC 2025**



PROJECT TRL:
**Start: 4
End: 6**



APPLICATION

Across Alberta, roughly 1,600 SAGD-producing wells operate with ESPs, with an average replacement rate of over 500 systems annually due to operational instabilities, often linked to gas slugs. The Gas Slug Handling System (GSHS) stabilizes ESP operation during high gas volume fraction (GVF) events, a common challenge in SAGD wells—especially those using non-condensable gas (NCG) injection. By maintaining liquid flow during slug events, the GSHS minimizes failures, extends pump life, and lowers emissions.

ALBERTA INNOVATES CLEAN ENERGY

ADVANCED HYDROCARBONS RECOVERY TECHNOLOGIES

PROJECT GOALS

- Complete the detailed engineering design of the GSHS prototype, including material selection, CAD modeling, and finite element analysis (FEA) to validate mechanical integrity under static and dynamic downhole conditions.
- Develop a single-phase Computational Fluid Dynamics (CFD) model to estimate pressure losses, identify recirculation issues, and define design optimizations.
- Create a calculation tool to size the GSHS based on field-specific flow rates and transient downhole conditions.
- Manufacture two full-scale GSHS prototypes for hydraulic testing and field trials, incorporating results from design and modeling phases.
- Conduct a simplified hydraulic test using a horizontal flow loop to evaluate pressure losses and flow behavior under representative flow rates.

BENEFITS TO ALBERTA

- Reduction in ESP failure rates, leading to extended equipment lifespans and fewer costly replacements.
- Lower energy consumption and operating costs through improved gas handling and stabilized pump performance.
- Minimization of unplanned production downtime, enhancing overall SAGD operational efficiency.
- Enabling broader adoption of NCG injection, which has demonstrated significant benefits in lowering Steam-to-Oil Ratio (SOR) and further reducing GHG emissions.
- Advancement of Alberta's innovation ecosystem through the development and field deployment of novel downhole technologies tailored for oilsands operations.
- Potential for future partnerships with Alberta-based academic and research institutions to support local expertise and talent development in clean technology for the energy sector.



2 Publications



1 EIT Trained



1 Patent



1 Project Job



2 Future Jobs



**1 New
Product/Service**



**37 kt/yr Future
GHGs Reduced**

CURRENT STATUS

MAY 2025

- Completed the first CAD model of the GSHS assembly
- Performed baseline CFD modeling
- Developed a preliminary version of the calculation tool to estimate GVF variation within the GSHS as a function of operating conditions