ALBERTA INNOVATES

CLEAN RESOURCES

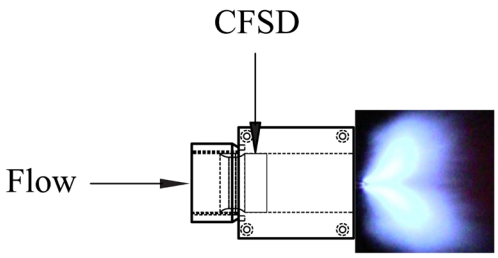
CLEAN TECHNOLOGY

HYDROGEN CENTRE OF EXCELLENCE

FUNDING DETAILS

Design and Development of Novel Hydrogen Powered Gas Burner Technologies

This project aims to develop an affordable active turbulence generator, a Compact Flow Stirring Device (CFSD), for methane-air burners, enhancing hydrogen blending in natural gas. This addresses the hydrogen blending risks like flashbacks in fuel premixing chambers. The generator will increase hydrogen blend limits, contributing to decarbonization and creating demand for hydrogen. The development includes experimental validation and high-fidelity simulations using data-driven methods. This advancement will benefit hydrogen-based thermal propulsion systems and industrial design, supporting the hydrogen economy transition.



RECIPIENT:
University of Calgary

PARTNERS:
University of British Columbia, Convergent Science

TOTAL BUDGET:
$1,193,000

AI HCOE FUNDING:
$583,000

PROJECT DATES:
FEB 2024 – FEB 2026

PROJECT TRL:
Start: 4
End: 6

APPLICATION

The Compact Flow Stirring Device (CFSD) targets a diverse customer base in the residential and commercial heating sectors, including heating system operators, facility managers, and homeowners, primarily in Alberta. This region aligns with Alberta's decarbonization goals, particularly under the Alberta Hydrogen Roadmap, which aims to integrate hydrogen into the province's natural gas distribution systems. Initially, the CFSD will support blending 15% hydrogen with natural gas, with the potential to handle higher blends exceeding 50%, significantly reducing greenhouse gas emissions.

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PROJECT GOALS

1. Redesign and integrate the CFSD device into a commercially available furnace.
2. Develop feedback control hardware and software for active turbulence generation.
3. Perform laboratory hydrogen-air flame temperature and velocity measurements subjected to actively generated turbulence for numerical tool development.
4. Construct a high-fidelity simulation database dedicated to the hydrogen/methane combustion system and characterize the limiting conditions of the device for hydrogen flashback.
5. Develop criteria for model adequacy with the goal of identifying key variables in detecting hydrogen flashback.
6. Use data-driven hydrogen flashback prediction and mitigation techniques based on experimental and numerical data.
7. Integrate the findings for physical and virtual prototypes that represent a near-desired hydrogen furnace system.

BENEFITS TO ALBERTA

- Provide local demonstration to end-users and original engine manufacturers (OEMs) to advance market development and acceptance of hydrogen-fueled burners.
- Training and development of nine students in specialized hydrogen end-use technologies, enhancing educational opportunities and skilled workforce in Alberta.
- Position Alberta as a leader in hydrogen burner technologies, aligning with provincial clean energy mandates.
- Increase economic equity and diversity through job creation in research, development, manufacturing, and maintenance of novel hydrogen burners.

7 Publications

9 Students Trained

1 Patent

1-5 Project Jobs

10-20 Future Jobs

2 New Products/Services

1 Spinoff Company

10-100 kt/yr Project GHGs Reduced

1000-4300 kt/yr Future GHGs

CURRENT STATUS

JUN 2024

The University of Calgary and the University of British Columbia project team have hired relevant students to work on the project. The team is now conducting relevant training and literature reviews for the project.