Global Research Initiative in Sustainable Low Carbon Unconventional Resources

Transforming energy research to fuel a clean energy future.

The Global Research Initiative in Sustainable Low Carbon Unconventional Resources (GRI) is a major vehicle to translate lab-based technology innovations into field-deployable solutions. Focused on collaborative research between the world-class innovators from the University of Calgary and international partners, the GRI creates a network of global hubs for discovery, creativity and innovation in unconventional energy research.

Originating from the $75 million Canada First Research Excellence Fund (CFREF) awarded to the University of Calgary in 2016, the GRI has made huge progress in generating clean-tech solutions by seeking new, innovative unconventional energy systems that are low or zero-carbon.

University of Calgary and University of Alberta Joint Research Collaboration

Both the University of Calgary and the University of Alberta share a common drive to build a low carbon, energy-efficient Canada. Both universities are combining their strengths and world-leading researchers to propel Canada towards a sustainable future by allocating a portion of their CFREF awards to create collaborative research projects within the mandates of both research programs.

6.5 million each

9 research areas

16 research projects

2 new jobs created

20 GRI faculty members involved

18 student opportunities created

14 postdoctoral fellows recruited

6 CFREF supported proceedings & publications

Projects

- Advanced electrochemical system for energy storage through CO_2 conversion
- Thermal impacts for geological storage of CO_2
- Unlocking the physics and chemistry of bitumen/water/solvent/porous media interfaces- an enabling technology for new production process development
- Reservoir management and advanced optimization for thermal and thermal-solvent based recovery processes using fundamentals, scaled models and machine learning
- Life-cycle assessment of energy system transitions
- Computational seismic full waveform inversion
- Monitoring the structural response of storage structures to CO_2 injection – exploring the potential of passive seismic monitoring
- Assessing political pathways for energy transition
- Low-cost catalysts and methodologies for partial upgrading of bitumen
- Dynamic Load Control and EV Charging Field Experiment

University of Calgary and University of Alberta Joint Projects

Advanced Electrochemical System for Energy Storage Through CO_2 Conversion

University of Calgary and University of Alberta teams independently developed some very promising catalytic mixed conducting electrode materials for use in solid oxide electrolysis cells (SOECs). The research intents to produce a stable, high-performing solid oxide electrolysis device that demonstrates tunable syngas production from CO_2, while also serving to store renewable and excess grid electricity, and to enable the scale-up of the cells by a factor of roughly 25 times in area.

Thermal Impacts for Geological Storage of CO_2

The goal of this project is to shed light on the significance of thermal impacts on CO_2 storage operations, have a better understanding of storage complex attributes that impact CO_2 injectivity and the security of CO_2 storage, and to accelerate secure geological storage of CO_2 as an important GHG emissions reduction strategy.

Unlocking the physics and chemistry of bitumen/water/solvent/porous media interfaces- an enabling technology for new production process development

This project concentrates on refining the understanding of interfacial dynamics to permit the design of new solvent packages that will yield significant reductions of greenhouse gas (GHG) intensity, improvements to energy efficiency, and offer the joint aspects of greater production rates and ultimate recoveries with the intent of improving the effectiveness of ongoing sub-surface operations.

Reservoir Management and Advanced Optimization for Thermal and Thermal-Solvent Based Recovery Processes Using Fundamentals, Scaled Models, and Machine Learning

This project is working to reduce steam requirements and maximize recovery for various thermal processes, thus significantly improving the emissions intensity and energy efficiency of the recovery processes while enabling real-time decision-making for optimization to improve existing operations and reduce emissions and water use.

Life Cycle Assessment of Energy System Transitions

Intended to close the knowledge gap and understand the environmental impacts economy-wide and globally of different energy transition pathways by means of techniques and results that will provide insights which can help guide/inform policy and technology development.

Computational Seismic Full Waveform Inversion

Researchers are incorporating multi-parameter elastic full-waveform inversion (FWI) with anisotropic variants (for fracture characterization) and viscoelastic variants (for viscosity characterization) into the unconventional reservoir surveillance world to reduce the computational burden of FWI, support the growing numerical toolbox, enable the important problem of parameter-resolution analysis, and reduce the number of seismic shot records input into the gradient calculation.

Monitoring the Structural Response of Storage Structures to CO_2 Injection – Exploring the Potential of Passive Seismic Monitoring

This project is designed to facilitate the detection of temporal variations in structures at CO_2 injection sites over several time periods and between two separate recording phases by using PS data to monitor CO_2 injection sites, as well as to improve the understanding of the response of reservoir formations to CO_2 injection.

Assessing Political Pathways for Energy Transition

This project is assessing the political viability of policies that support the transition to low-carbon energy strategies, including the explicit phasing out of high greenhouse gas (GHG) emitting energy generation. This will be done through the understanding of how the public reacts to energy transition policy especially when Indigenous consent may be mandatory for projects to go forward.

Low-cost catalysts and methodologies for partial upgrading of bitumen

This project focuses on finding innovations in science to meet or exceed pipeline specifications for the transportation of bitumen by developing and demonstrating new concepts in catalyst design, molecular and nanoscale, and new process technology adapted to the requirement for mild, energy-efficient reaction conditions, unprecedented for bitumen processing.

Dynamic Load Control and EV Charging Field Experiment

In collaboration with British Columbia Hydro, researchers are designing a first-of-its-kind randomized control trial to evaluate methods to reduce peak electric demand. Our analysis aims to evaluate whether price or automation treatments are more effective at motivating consumers to adjust their demand and/or the timing of EV charging.

University of Calgary faculty members involved in these joint projects are Profs. Joule Bergerson, Viola Birss, Steven Bryant, David Eaton, Ian Gates, Hersh Gilbert, Hassan Hassanzadeh, Hossein Hejazi, Josephine Hill, Jinguang Hu, Kristopher Innanen, Apostolos Kantzas, Donald Lawton, Bernhard Mayer, Giovannianotonio Natale, Sathish Ponnurangam, Venkataraman Thangadurai, Melanee Thomas, Simon Trudel and Harvey Yarranton.

Driving Innovation. Fueling Results.

Partner with UCalgary and help us transform energy research to fuel a clean energy future.
Get started: **ucalgary.ca/gri**

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CANADA FIRST RESEARCH EXCELLENCE FUND