



The CREATE-REDEVELOP program: Building relationships with Indigenous communities in a graduate-student training setting

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Summary

The REDEVELOP (Responsible Development of Low Permeability Resources) initiative was established at the University of Calgary in 2017, with funding from NSERC's CREATE (Collaborative Research and Training Environment) program. REDEVELOP provides interdisciplinary team-oriented training for graduate students in engineering, geoscience, policy and business at five universities (Alberta, Western, Waterloo, Toronto and Calgary), as well as Indigenous interns. It trains future leaders in government, industry, and academia by emphasizing a holistic approach to problem-solving in Canada's ongoing energy transformation, highlighting interconnections that crosscut these disciplines as well synergies between Indigenous ways of knowing and western scientific methods. Since its inception, 83 REDEVELOP grad students and undergrad interns have received professional and experiential training and scholarships, including a 4-day Indigenous relations workshop provided by the Writing Symbols Lodge at the University of Calgary. For most students, this training component is their first introduction to Indigenous history in Canada. Some trainees complete the 4 Seasons of Reconciliation short course delivered online by First Nations University. In addition, each REDEVELOP student team partners with an Indigenous community or business when working on their team projects. This has helped to build close working relationships with partners, such as the Indian Resource Council, which has provided critical guidance to foster understanding of the variability of Indigenous cultures in western and northern Canada. This paper and presentation will show how this national initiative has developed and flourished, illustrated by key success stories.

Introduction

The concept of *responsible development* entails a holistic approach integrating economic, environmental, and social considerations, based on transparent, science-informed regulations that inspire public confidence. This concept lies at the heart of the REDEVELOP initiative (*Responsible Development of Low-Permeability Unconventional Resources*), a novel interdisciplinary postgraduate training program initiated by the University of Calgary in 2017, together with students and faculty from four other Canadian universities: Alberta, Western, Waterloo and Toronto. From the outset, the vision for this program was to contribute to Canada's leadership during the global transition to a low-carbon future. Graduate students in Science and Engineering typically develop expertise in a specific area; however, additional soft-skills are needed to understand and communicate critical social, business, policy and regulatory aspects

— key tenets of responsible development. Working in an interdisciplinary team environment, graduates of REDEVELOP acquire these skills in order to serve as expert ambassadors to the media, Indigenous communities, and policy makers, while providing technical and scientific leadership to drive innovation across a vast range of scales and disciplines.

When REDEVELOP was initially conceived in 2016, key socioeconomic drivers included:

1. **Increasing energy demands.** With a 40% increase in population over five decades since 1970, Canada, faces unprecedented challenges in supplying cost-effective sustainable energy to meet growing demands.
2. **Long-term prospects for development of tight oil and gas resources.** Technological developments since the start of the millennium have unlocked vast energy resources in the form of hydrocarbons contained in low-permeability rock formations.
3. **Imminence of the global energy transition.** Reductions in greenhouse gas (GHG) emissions from energy systems remain essential for the world to mitigate the impacts of climate change.
4. **Importance of an interdisciplinary approach.** For informed decision-making, future leaders within industry, government and Indigenous communities rely on understanding that crosscuts traditional knowledge and technical knowledge derived from western disciplines in the natural sciences.

Since an innovative idea is only as good as one's ability to explain it, effective communication of credible, science-based information is critical. With this in mind, REDEVELOP put in place a set of learning objectives to prepare graduate students for leadership roles in the workforce:

- Learn how to extract documented information from credible sources, such as peer-reviewed journals. This information is usually a product of western scientific method.
- Learn how to extract undocumented information from credible sources, such as Indigenous elders and knowledge-keepers. This information might comprise either traditional knowledge or more recent ecological or socio-economic observations.
- Learn to discern fact from fiction in traditional and social media articles. This includes validating information using more than one independent source and digging deep to verify the credibility of those sources.
- Build relationships with people from different communities and take the time to understand cultural differences, historical barriers, current challenges and to establish mutual respect to find a path forward together.
- Achieve a deep understanding of the art of communication in written, verbal, numerical, pictorial and animated forms of expression. While some forms of information transfer may be unilateral, effective communication is multilateral, relying on spoken and unspoken feedback to guide and adapt its direction.
- Learn strategies for effective conflict resolution and project management taken from industrial-organizational psychology, as a member of an interdisciplinary, multi-university team. It is inevitable that groups of people working together on a meaningful project will not always agree; the potential for conflict is compounded by the constraints of virtual

communication (as opposed to in-person), which can impede sharing information, problem-solving and making decisions.

- Achieve a foundational understanding of Indigenous culture, history in Canada and the 94 Calls to Action established by the Truth and Reconciliation Commission in 2015, to develop effective inclusivity practices, both professionally and personally.

These strategies are applied within REDEVELOP through systematic exploration at the *intersection* of science and policy. This is achieved through a series of technical, academic, and cultural workshops, and then tested within a four-component competition. In this annual competition, teams of students complete:

- 1) a scientific poster for presentation at a conference;
- 2) a policy paper suitable for publication in an academic journal;
- 3) a 90-second video aimed at a general audience; and
- 4) a 20-minute presentation for a technical audience.

These components are followed by a 30-min Q&A in a Dragon's Den format, where experts from academia, industry, and government (Indigenous and non-Indigenous) grill student teams to probe their critical thinking and depth of understanding.

Evolution of the Program

The REDEVELOP program originally focused on low-permeability unconventional resources, emphasizing the need for transformative technology and policy adaptations to ensure near-term energy supply while also meeting long-term climate commitments. Since the first student cohort began this program in September 2017, it has evolved to keep pace with rapidly transforming energy systems. Table 1 highlights this evolution, which summarizes project topics chosen by student teams over the past four years.

Research challenges faced by student teams during year 1 of the program revealed that students were often uncomfortable having conversations with mentors from industry and government, largely due to a lack of practice communicating verbally with professionals. This lack of comfort was heightened when engaging with Indigenous Peoples. Students expressed concerns that their cultural knowledge was inadequate and that they might unintentionally offend an elder.

This feedback was pivotal in developing a training program that helped young professionals overcome these barriers to meaningful conversations and relationship-building. Industrial-organizational (I/O) Psychology workshops or interventions were integrated into the training program by the ITP Metrics Lab at the University of Calgary, with one additional intervention incorporated each year. The coaches from the ITP Lab are PhD students of I/O Psychology and coach teams in verbal communication and conflict resolution. For most students, the integration of the Indigenous Relations into their training, delivered by the Writing Symbols Lodge at the University of Calgary, was their first introduction to Indigenous culture and history in Canada.

Table 1. Summary of energy solutions proposed by interdisciplinary student teams, highlighting the intersection of science and policy while integrating perspectives from Indigenous people.

2018	2019	2020	2021
Supplying Energy to Remote Communities with Liquefied Natural Gas (LNG) as a clean alternative: Freeze or go full steam ahead?	Utilizing Ground Motion in the Traffic Light System to better estimate potential damages caused by induced seismic events in Alberta.	Geomechanical Modeling of Potential Leakage Pathways through caprocks at natural gas storage sites; AND Modernizing Caprock Integrity Regulations for natural gas storage sites to mitigate fugitive gas emissions.	Investigating the Feasibility of Hydrogen to reduce diesel reliance in remote communities; AND Analysis of the Policy Options to adopt hydrogen for electricity generation in Nunavut remote communities.
Hydraulic Fracturing in Canada: Risk vs. Reward: Addressing risks of hydraulic fracturing with novel drilling and stimulation technologies.	Reducing Freshwater in Hydraulic Fracturing: An analysis of fracturing fluids used in the Montney Formation in Alberta; AND Policy recommendations to encourage water reduction.	Comparative Analysis of Canadian LNG to Global Natural Gas Supply: Shaping Canada's Energy Future; AND Comparison of Policy Alternatives to reduce GHGs from potential Canadian LNG facilities.	Western Canadian LNG: A Pathway to global GHG reduction and reconciliation.
Induced Seismicity, Well Azimuth and Completion Economics in the Duvernay; AND A Study of the Traffic Light System.	Risks and Mitigations for Hydraulic Fracturing Wastewater Disposal Operations in Western Canada; AND Mitigating Risk through Water Policy.	Bitumen Transportation Bottleneck Solved? How Transporting Alberta's solid bitumen via rail compares to pipelines; AND Current Regulatory Framework and Gaps.	Geothermal Greenhouses: Addressing Food Insecurity in Yukon using clean energy; AND A Review of Yukon geothermal and cold-climate agriculture policies.
Pipeline vs. Rail: Quantitative comparison between the transportation of crude oil and the cost to society; AND Indigenous Participation in Canada's Oil Industry: Attaining economic growth through strengthened fiscal relationships.	Mitigation of Induced Seismicity that is Triggered by Hydraulic Fracturing; AND Predicting and Mitigation Induced Seismicity in Oil/Gas Operations in Alberta and British Columbia.	Upcycling Orphan Wells in Alberta: Repurposing opportunities with a new evaluation system.	The Impact of CCUS Infrastructure on the Levelized Cost of Electricity at Cascade; AND Impact of Alberta Emissions Reduction Policies on the feasibility of CCUS at natural gas power plants.
Toward a Better Understanding of Methane Emissions from individual energy wells in Canada; AND Insights into Alternative Policies in Regulating Fugitive Gas Emissions.			
Analysis of Contamination, Remediation and Geothermal Potential of Orphan Wells in Alberta, and alternative policies for managing them.			



While the experience often provokes an emotional response, it is a critical part of our anthropological history that alumni describe as a highlight of their REDEVELOP training, covering the following eight modules over four days.

- 1) Indigenous ways of knowing;
- 2) Historical overview;
- 3) Current issues of Indigenous people in Canada;
- 4) Education and employment (history and current trends);
- 5) Socio-cultural issues in the north;
- 6) Economic development and environmental issues;
- 7) Resource development in Indigenous communities; and
- 8) Building strong community relations.

Being able to speak freely and respectfully with Indigenous Peoples, while mindful of their diversity in culture and variability in protocol, is the emphasis of this component of REDEVELOP training. It has proven to be a very positive "first step" in developing graduates with a holistic approach to problem-solving in an inclusive think-tank of people.

Understanding Indigenous Perspectives

In year 1 of the REDEVELOP program, the Indian Resource Council was instrumental in introducing student teams to Indigenous individuals from communities concerned or impacted by their topic of choice. While these individuals were briefed on the mission of the REDEVELOP program, the applicability of graduate student training in Indigenous communities was not obvious, and the students' lack of cultural understanding was not helping to foster meaningful conversations. With the implementation of Indigenous Relations Training in year 2, students exhibited more confidence when engaging with Indigenous mentors, but they were still somewhat unprepared with questions. This likely reflected a difficulty associated with knowing what questions to ask in the absence of a foundational understanding of the current socio-economic status of a specific community. These concerns generally fall outside of the domain of scientific literature. Notwithstanding these challenges, Chief Jim Badger, of the Sucker Creek First Nation, took the time to sit down with two teams of REDEVELOP students to have a conversation. It was a turning point in the program's progress, catalyzing the creation of the NIYAK Project that is covered in a separate contribution to this conference. By year 3, students were encouraged to "know their audience" when engaging with an Indigenous mentor. Developing this understanding involved a series of questions: What are their socio-economic challenges today? What is the background story? Are there environmental concerns with the proposed energy option? Does it employ people in the community?

The REDEVELOP program has recently completed its fourth year. Students presenting their research in the 2021 meeting all had the opportunity to engage with Indigenous elders to speak freely, share information and discuss the advantages and disadvantages of potential solutions. This reflects significant progress since the onset of the REDEVELOP program in 2017.



Figure 1. REDEVELOP students enter the workforce with a graduate degree in Geoscience, Engineering or Public Policy, coupled with training that prepares them for Canada's changing energy sector.

Summary and Outlook

The REDEVELOP training can be described as a journey of self-discovery. It provides opportunity for students to look beyond their academic degree goals, improve self-esteem (among friends) and to consider the type of contributions they will make to their chosen field of study and to humanity. It provides unique interdisciplinary training for the workforce in the energy industry, academia and government that is both collaborative and competitive (Figure 1).

Importantly, REDEVELOP is a graduate-student training model that is adaptable. With the economic downturn in the oil and gas sector in 2019, followed by a global pandemic in 2020 and increasing concerns about climate change, we rebranded REDEVELOP with a wide scope of energy topics to better prepare graduates for a changing workforce. By introducing topics like: the hydrogen economy; geothermal energy; and carbon capture, utilization and storage; student teams learned to apply their critical thinking skills to unfamiliar areas of research and to think outside the box. In 2021, some took the initiative to explore applications in northern communities, which also involved expanding their knowledge of Indigenous ways of being in the circumpolar region of Canada. Table 1 is a summary of the energy solutions proposed by 18 student teams over the past 4 years.

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