



CLEANTECH CAREER AREA: NOVEL HYDROCARBON EXTRACTION

CLEANTECH AND TRANSITIONING CAREERS IN OIL & GAS

Career opportunities across Alberta's oil & gas innovation ecosystem

INTRODUCTION

To address climate change and improve environmental performance across a variety of industries requires innovation and new technologies to be developed quickly.

In this environment there is great opportunity for Alberta's workforce including experienced workers, students and new graduates, career counselors and human resource professionals, training and education institutes, innovators, entrepreneurs and employers and their hiring managers.

There is growing demand for all levels of skills and experience in innovation, technology and 'cleantech' development, as well as for the many supporting or related roles that will help apply these new solutions across many industries.

This document, and seven others in the *Cleantech and Transitioning Careers in Oil and Gas* series, is a guide to developing or adapting skills and experience for meaningful work and careers with direct impact on the environment and the economy, even as our province's resource industries transition to help meet climate challenges.

This series uses examples from Alberta's oil and gas industry. However, cleantech skills and roles are also in demand among agriculture, forestry, manufacturing, transportation and other sectors that are vital to the sustainability of our province.

NEW CAREER AREAS IN NOVEL HYDROCARBON EXTRACTION

Oil and gas will continue to be part of the global energy mix for decades to come. The way Canada produces oil and gas is changing with an urgent need for new technologies that optimize production while reducing the industry's environmental impact.

Evolving oil and gas production and extraction technologies are among the most impactful changes

industry can make to improve environmental performance. These changes include technologies that can be applied to new greenfield projects as well as to existing projects, enabling operators to increase production while reducing emissions and their overall environmental footprint.

Innovation is changing the oil and gas industry and creating new career opportunities for Albertans

Despite the benefits of new methods of hydrocarbon extraction, engineering new technologies is technically and intellectually challenging, in part due to the complex subsurface behaviour of oil and gas. Some of today's methods took decades to transition from concept to commercialization because of the capital intensity of innovation and the need to mitigate potential risk to the reservoir reserves.

To shorten the innovation curve, new hydrocarbon extraction technologies will need to harness the amazing amount of discovery that has already occurred in the industry and apply it across the innovation ecosystem. Enabling solutions for the extraction and production of oil and gas while decreasing environmental impacts requires a team that combines the deep knowledge already found in the oil and gas industry with innovation and technology development expertise. It also requires agile engineering and the use of innovative technologies such as 3D printing, nanotechnology and simulations using Augmented Reality or Virtual Reality (AR/VR.)

What is Novel Hydrocarbon Extraction in the Oil and Gas Industry?

Novel hydrocarbon extraction means using new technologies to optimize oil and gas production while reducing the industry's impact on land, air and water.

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Novel hydrocarbon extraction technology currently in development in Canada includes:

- **Improving field development** using recovery processes that increase production while decreasing emissions, the land footprint and the use of water. Examples include using solvents and electric heating processes to enhance recovery of in-situ oil sands reserves, using carbon injection to enhance oil recovery, employing downhole treatments to restart or reinvigorate previously shut-in or uneconomic wells, and using multi-lateral horizontal drilling. Increased production from existing wells means fewer wells need to be drilled.
- **Applying digital technology** and data integration and analytics to characterize and understand complex reservoirs and simulate production in the lab prior to application in the field.
- **Innovating well architecture** and completions processes, with a focus on technology that encourages a greater portion of reserves to migrate to the surface.

The science and engineering of fluid mixing and geomechanics, and the technology developed for hydrocarbon extraction, also apply to other key elements of the global energy transition including carbon capture, utilization and storage (CCUS) and geothermal energy.

CAREER PATHWAYS FOR NOVEL HYDROCARBON EXTRACTION

Universal Attributes Required

Alongside technical skill requirements, workers in cleantech careers (in any industry) require important universal attributes. These are also known as soft skills, attitudes or behaviours.



WORKING IN NOVEL HYDROCARBON EXTRACTION

Key phases required to transition novel hydrocarbon extraction from laboratory to field deployment, and to address the emissions and environmental challenges faced by the oil and gas industry include:

- **Laboratory testing and development** of prototypes, conducting lab experiments that simulate the operational environment and allow for numerical modelling, and economic analysis to assess field readiness.
- **Large scale field piloting and demonstrations** of laboratory tests to further analyze and solve any design, engineering and process challenges prior to a commercial pilot.
- **Field deployment** of a commercial pilot to evaluate and develop potential routes to further scale technology adoption.



Want more details on activities within the Novel Hydrocarbon Extraction sector?

Find Novel Hydrocarbon Extraction Key Activities on the Clean Resource Innovation Network (CRIN) website:

WWW.CLEANRESOURCEINNOVATION.COM



KEY SKILLS AND OCCUPATIONS TABLES

The following tables outline the full lifecycle of novel hydrocarbon extraction and the skills, knowledge, and occupations required to enable solutions for extracting and producing oil and gas while decreasing environmental impacts.

KEY SKILLS & KNOWLEDGE	LABORATORY TESTING AND DEVELOPMENT <i>Mitigating technical and reservoir risks</i>	FIELD PILOTING AND DEMONSTRATIONS <i>Larger scale field pilot of laboratory tests</i>	FIELD DEPLOYMENT <i>Commercial pilot and assessment of upscale potential</i>
	<ul style="list-style-type: none"> • Understanding of oil and gas geology and reservoirs • Understand industry language and can communicate the value proposition • Agile engineering • Technology development planning • Data analytics and evidence-based decision making • Risk management and mitigation experience • Ability to focus and prioritize solutions • Attention to detail • Ability to develop partnerships and expand value chains • Commercialization and funding skills • Define potential of commercial products and market scalability • Understanding of IP, user rights, patenting and contracts • Ability to navigate multiple technologies and digital tools • Design and build prototypes utilizing a variety of materials • Critically analyze and evaluate own findings and those of others • Generate novel approaches to issues and implementing solutions • Ability to ask questions and frame the core problem 	<ul style="list-style-type: none"> • Understanding of oil and gas geology and reservoirs • Understand industry language and can communicate the value proposition • Ability to train field and other staff • Operational risk assessment and mitigation knowledge • Data analytics and evidence-based decision-making skills • Attention to detail • Environmental risk assessment experience • Regulatory permitting knowledge • Ability to develop partnerships and expand value chains • Indigenous engagement experience • Stakeholder engagement experience • Ability to navigate regulations 	<ul style="list-style-type: none"> • Understanding of oil and gas geology and reservoirs • Understand industry language and can communicate the value proposition • Ability to train field and other staff • Operational risk assessment and mitigation knowledge • Data analytics and evidence-based decision-making skills • Understanding of what it takes to scale • Business development skills and knowledge of how to collaborate with investors, customers and partners • Commercialization skills including: <ul style="list-style-type: none"> • Strategy and planning • Finance and funding • Market knowledge • Business acumen • Commercial deployment mind-set and execution skills • Ability to establish trust and confidence • Networking, sales and marketing skills • Ability to navigate regulations • Proficiency with Interactions with regulators, stakeholders, other partners and industry



KEY OCCUPATIONS	LABORATORY TESTING AND DEVELOPMENT <i>Mitigating technical and reservoir risks</i>	FIELD PILOTING AND DEMONSTRATIONS <i>Larger scale field pilot of laboratory tests</i>	FIELD DEPLOYMENT <i>Commercial pilot and assessment of upscaled potential</i>
	<ul style="list-style-type: none"> • Research scientists • Engineers: reservoir, process, materials, chemical • Technologists: reservoir, process, CAD • Industrial designers • Lab technicians • Geologists • Geophysicists • Software developers • Data scientists • Hardware developers • Licensing, contracts and patenting specialists • Proposal writers 	<ul style="list-style-type: none"> • Engineers: reservoir, process, completions, materials, chemical • Technologists: reservoir, process, completions, CAD • Field and production operators • Geologists • Geophysicists • Technical trainers • IT and OT (operations technology) specialists • Software developers • Data scientists • Project managers • Contract managers • Supply chain managers • Cost management specialists • Regulatory specialists • Environmental specialists • Health & safety specialists • Stakeholder engagement professionals • Product managers 	<ul style="list-style-type: none"> • Engineers: reservoir, process, completions, materials, chemical • Technologists: reservoir, process, completions, CAD • Field and production operators • Trades • Geologists • Geophysicists • Technical trainers • Data scientists • IT and OT (operations technology) specialists • Software developers • Hardware developers • Business development and marketing professionals • Project managers • Contract managers • Supply chain managers • Health & safety specialists • Environmental specialists • Stakeholder engagement professionals • Product managers

The **Cleantech and Transitioning Careers in Oil and Gas Series** is the result of a 2021 project funded by the Province of Alberta working in partnership with the Government of Canada, and research conducted by consultants Cheryl Knight and Pat Hufnagel-Smith.

For more information please contact: info@cleanresourceinnovation.com and to view or download documents in the series, visit www.cleanresourceinnovation.com