



CLEANTECH CAREER AREA: LOW EMISSIONS PRODUCTS

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 NEW CAREER AREAS IN LOW EMISSIONS VALUE-ADDED PRODUCTS

Oil and gas will be an important part of the global energy mix for many years. However, meeting global demand while improving the environmental performance and sustainability of the oil and gas industry is a complex challenge. A key opportunity to meet this challenge is to leverage, develop and deploy technology and expertise in ways that reduce carbon and emissions and offer society valuable products.

Beyond its use as a vital element of the global energy supply, oil and gas is the energy source required to produce steel, cement, plastic and chemicals, all of which are critical building blocks for our economy. These sectors are not easily electrified and will rely on hydrocarbons for the foreseeable future. Making oil and gas more sustainable will therefore have a positive impact on the carbon intensity associated with these sectors.

What are low emissions, value-added products in the oil and gas industry?

Innovations that have the potential to reduce the carbon intensity of traditional oil and gas production and convert hydrocarbon raw materials into innovative products of higher value.

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

- **Bitumen Beyond Combustion** refers to the production of non-fuel, high-value materials from Alberta's oil sands that result in opportunities to reduce GHG emissions while making products we use in everyday life. Examples include carbon fibre as a lightweight material for vehicles, aircraft, bicycles and other machinery; asphalt binder as a waterproof coating for pavement; and activated carbon to purify gases and liquids including drinking water.

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- **Hydrogen** offers enormous potential to decarbonize many sectors of our economy including resource extraction, freight, transportation, power generation, manufacturing, and the production of fertilizer, steel and cement. Canada is one of the largest hydrogen producers in the world, and our ample fossil fuel reserves can be converted to low-cost, low-carbon hydrogen through reformation and carbon capture and storage (CCS), also known as “blue hydrogen.” Our extensive pipeline network can also be exploited by moving hydrogen from production facilities to major industrial users.
- **Carbon Capture, Utilization, & Storage (CCUS)** refers to technology that removes carbon directly from the atmosphere and from the processes associated with oil and gas production. CCUS is also essential for low-carbon hydrogen production. Research and innovation in technology continue to explore ways to convert and utilize captured carbon dioxide. Currently, captured carbon is most commonly used for producing biofuels and for enhanced oil recovery, which extends the life of an oil reserve while sequestering the carbon. Other potential uses include creating base materials for a wide range of products such as concrete, batteries, adhesives and pharmaceuticals.
- **Extracting Minerals** is critical to the sustainable energy transition as they are a necessary component of the battery supply chain and are needed for the electrification of power and for transportation industries.

In Canada, extraction of lithium and other rare minerals such as vanadium, titanium and nickel, involves repurposing oil and gas production and water disposal wells and oil sands tailings ponds. Compared to other jurisdictions, Canadian lithium extraction technology requires a much smaller land footprint and does not consume fresh water or create new tailings ponds.

As Canada’s automotive manufacturing sector moves to increase its production of electric vehicles as a path to net zero emissions, having a national supply of lithium is a huge advantage for domestic consumption and export.

- **Geothermal Energy** involves extracting the thermal energy from the earth’s interior as a source of constant, clean baseload power or heat on a utility-scale. It can be used for residential, industrial and commercial settings and also supports industries such as tourism (hot baths) and agriculture (greenhouses).
- **Partial Upgrading** reduces the requirement for the agent use to increase the viscosity of bitumen (diluent) by 50% or more and materially reduces costs and the environmental impacts associated with transporting heavy oil to market.

Customers are required for the low emissions value-added products derived from oil and gas production. Advancing the full value-chain and long-term contracts with both domestic and international markets are critical to establishing Canada as a leader in these unique clean technology opportunities.

CAREER PATHWAYS FOR LOW EMISSIONS VALUE-ADDED PRODUCTS

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.



AGILITY

Adapt to changes, feedback and iterations



SYSTEMS THINKING

Ask right questions, visualize work and accommodate ongoing feedback

STRATEGIC FOCUS

For commercial deployment and monetization of ideas



EMOTIONAL INTELLIGENCE

Work well with others in a changing environment



BUSINESS ACUMEN

Create value for the business and customers



RELATIONSHIP BUILDING

Mutual respect and trust amongst team members and customers

PERSEVERANCE & CONTINUOUS IMPROVEMENT

Incorporate ongoing learning and achieve technical excellence



TRUST & COLLABORATION

Work collectively on problems



COMMITMENT & PASSION

Improving the future through “out of the box” and visionary thinking



COMMUNICATIONS SKILLS

Share important stories of successes and failures and inspire involvement



KEY SKILLS AND OCCUPATIONS TABLES

Using the four phases identified above, the following table outlines the full lifecycle of producing and refining low-carbon or cleaner fuels, including the downstream distribution and handling of cleaner fuel products to end-users, facilitating the transition to a circular economy. You'll also find the applicable skills, knowledge, and occupations in each stage.

ACTIVITIES, SKILLS & KNOWLEDGE REQUIREMENTS	CORE OCCUPATIONS INVOLVED	TECHNOLOGIES & LOW EMISSIONS VALUE-ADDED PRODUCTS					
		BITUMEN BEYOND COMBUSTION	CCUS	GEOTHERMAL ENERGY	HYDROGEN (BLUE)	PARTIAL UPGRADING	RARE MINERALS & GAS EXTRACTION
Administration and business support: <ul style="list-style-type: none"> Socio-economic impact assessments Stakeholder engagement Indigenous engagement Supply chain management 	<ul style="list-style-type: none"> Accountants Production accountants Tax accountants Business development and marketing professionals Commercial development specialists Stakeholder engagement professionals HS&E specialists ESG/Sustainability professionals Human resources specialists 	X	X	X	X	X	X
Asset management: <ul style="list-style-type: none"> Systematic approach to developing, operating, maintaining, upgrading and divesting assets in the most cost and performance-effective manner 	<ul style="list-style-type: none"> Asset managers Asset management analysts 		X	X	X	X	X
Information technology/ operations technology: <ul style="list-style-type: none"> Data management Data acquisition & analysis Business analysis Automation 	<ul style="list-style-type: none"> Data analysts Data scientists IT and OT (operations technology) specialists Software developers Software engineers Database analysts and administrators Information systems testers Network testers User support specialists Instrumentation technicians 	X	X	X	X	X	X
Environmental assessment, permitting and monitoring services: <ul style="list-style-type: none"> Navigating regulatory environments Site assessments Emissions measurement, reduction & reporting On-site emissions detection Seismology 	<ul style="list-style-type: none"> Measurement specialists Detection technicians Environmental specialists/advisors Regulatory specialists Government relations specialists Lawyers/regulatory specialists 	X	X	X	X	X	X



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Laboratory testing: <ul style="list-style-type: none"> Metallurgical testing Gas sampling and analysis Water sampling and analysis 	<ul style="list-style-type: none"> Sampling and analysis technicians Lab technicians 	X	X	X	X	X	X
Pipelines: <ul style="list-style-type: none"> Operating gathering and/or transmission pipelines 	<ul style="list-style-type: none"> Pipeline technicians 		X	X	X	X	
Process manufacturing/plant operations: <ul style="list-style-type: none"> Creation of value-added goods by combining supplies, ingredients or raw materials, often requiring chemical and/or thermal conversion 	<ul style="list-style-type: none"> Process/Chemical engineers Process/Plant operators 	X	X	X	X	X	X
Production optimization: <ul style="list-style-type: none"> Measuring, analyzing, modelling, prioritizing and implementing actions to enhance the productivity of a field or process 	<ul style="list-style-type: none"> Production engineers Production engineering technologists Facility engineers 	X	X	X	X	X	X
Predictive maintenance: <ul style="list-style-type: none"> Use data analysis tools and techniques to detect anomalies in operations, possible defects in equipment and processes so they can be corrected before they can result in failure 	<ul style="list-style-type: none"> Instrumentation technicians Electricians Insulators Welders Steamfitters/pipefitters Predictive maintenance planners/schedulers 		X	X	X	X	X
Reservoir modelling & engineering: <ul style="list-style-type: none"> Use of computer models to estimate reserves and inform decisions related to development of the field, production predictions, placement of wells and overall reservoir management 	<ul style="list-style-type: none"> Reservoir engineers Reservoir engineering technologists Geophysicists Geologists 		X	X	X		X
Sub-surface geology: <ul style="list-style-type: none"> Determine the presence of sub-surface deposits Model the sub-surface framework of the reservoir/deposit Interpret seismic data to define the reservoir and characterize rock and fluid properties 	<ul style="list-style-type: none"> Geologists Geophysicists Hydrologists Seismic operators 		X	X	X		X



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Well design and engineering: <ul style="list-style-type: none"> Planning all mechanical aspects of a well including well integrity, completions and stimulation, etc. 	<ul style="list-style-type: none"> Drilling engineers Well engineers Completions engineers 		X	X	X		X
Drilling: <ul style="list-style-type: none"> Drilling a wellbore into the ground to extract natural resources following a technical drilling plan Drilling a wellbore used to inject fluids (typically) to maintain reservoir pressure Gathering and interpreting digital data to inform actions 	<ul style="list-style-type: none"> Rig managers Drillers (all levels) Measurement While Drilling (MWD) operators Medics 		X	X	X		X
Well completions and stimulation: <ul style="list-style-type: none"> In-field implementation of the well completions and stimulation plan 	<ul style="list-style-type: none"> Pumping operators Cementing operators Well testing operators Wireline operators Medics 		X	X	X		X
Well operations: <ul style="list-style-type: none"> Ongoing monitoring of well performance metrics to ensure optimal productivity 	<ul style="list-style-type: none"> Field/production operators Well operators 		X	X	X		X
Well maintenance and servicing: <ul style="list-style-type: none"> Preventative maintenance and repair of wells to ensure smooth and optimal production 	<ul style="list-style-type: none"> Well services supervisors Service rig crews: <ul style="list-style-type: none"> Operators Drillers Derrickhands Floorhands Leasehands 		X	X	X		X

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