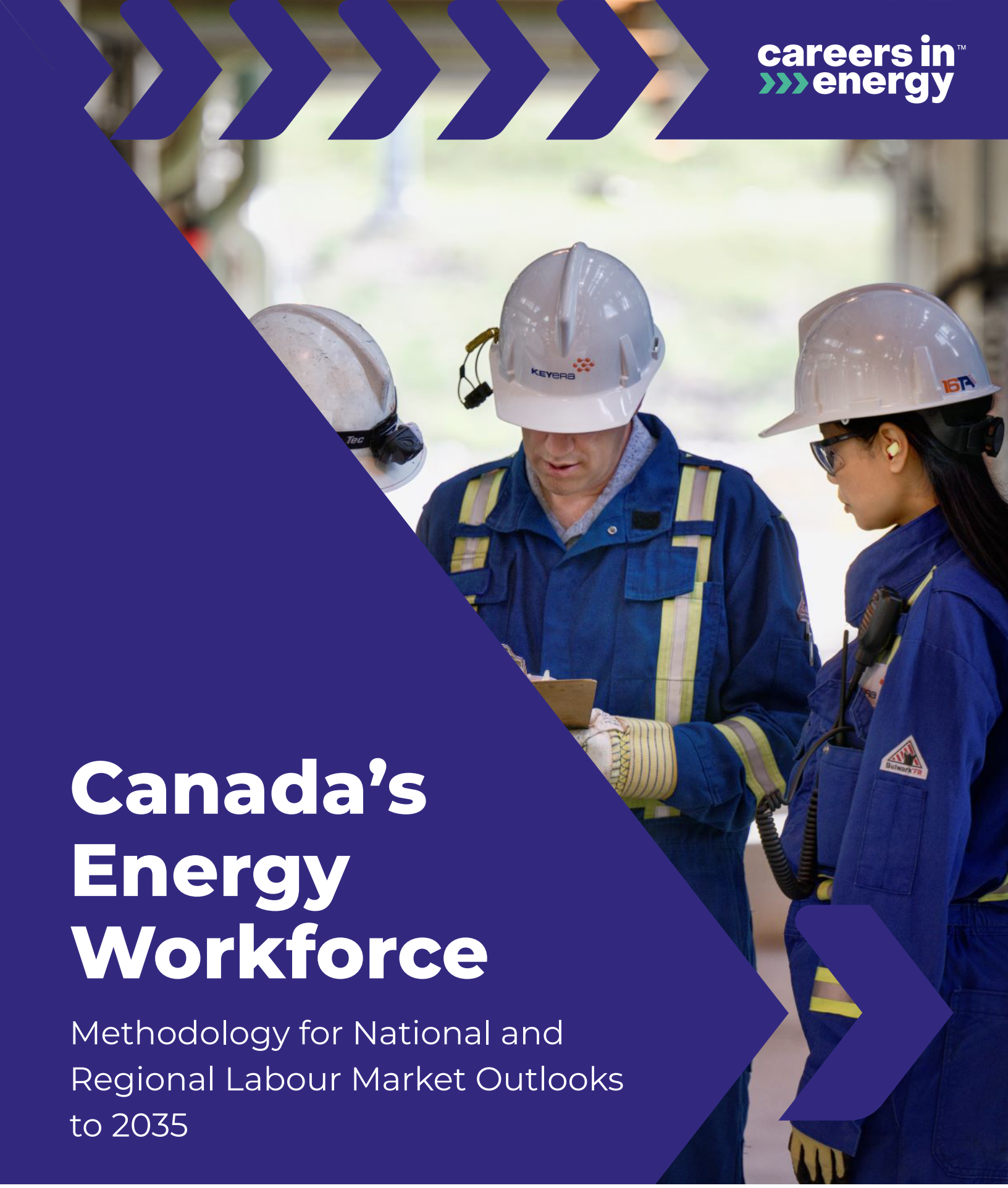
careers in energy™



Canada's Energy Workforce

Methodology for National and Regional Labour Market Outlooks to 2035

Photo courtesy of Keyera

February 2024

Canada

Funded in part by the Government of Canada's Sectoral Workforce Solutions Program

List of Tables

Scope and methodology

Careers in Energy (CIE)'s labour market outlooks are produced using a proprietary modelling system first developed in 2006 and continually refined and validated since then in consultation with industry representatives, labour market economists and workforce planning analysts.

For the first time, *Canada's Energy Workforce: National Labour Market Outlook to 2035* and its companion regional reports, provide a significant expansion to the CIE modelling system to more accurately reflect industry and occupational changes occurring within Canada's energy system.

Sector scope expanded

CIE expanded its labour market modelling system beyond established oil and natural gas sectors to include petroleum refining and four emerging energy sectors and technologies.

Established sectors

- Conventional exploration and production (E&P)
- Oil sands
- Energy services
- Pipelines
- Petroleum refining – new

Emerging sectors and technologies

- Biomass-based fuels - new
- Low-carbon hydrogen - new
- Liquefied natural gas (LNG) - new
- Carbon capture and storage (CCS) - new

Occupational scope

CIE's labour market modeling system includes 81 occupations that are core to production, operations and maintenance in the sectors that are "in-scope" in its outlooks. The occupations are mapped to the 2021 National Occupational Classification (NOC) system[1] that identifies and categorizes occupations based on five levels using training, education and experiences and responsibilities they require. CIE has mapped the occupations to a NOC code level of 4- and 5-digits and categorized the 81 in-scope occupations into 10 groups (Table 1). These 10 occupational groups account for a sizable proportion of all in-scope sectors' workforce—between 70 and 99%. The "other occupations" category represents the remaining workforce not represented within the 10 groups. Table 2 outlines the occupations included in each occupational group.

Table 1: In-scope occupations by occupational group, all sectors

Occupational group	E&P	Oil sands	Energy services	Pipelines	Petroleum refining	LNG	Biomass-based fuels	Low-carbon hydrogen	CCS
Business and operations support	6%	5%	4%	11%	4%	3%	3%	10%	11%
Energy drilling, servicing and field operations	11%	3%	22%	3%	2%	0%	0%	0%	3%
Engineers	11%	15%	3%	14%	9%	8%	8%	20%	26%
Facility operations	18%	24%	7%	20%	32%	31%	31%	30%	24%
Geoscientists	2%	1%	2%	0%	0%	0%	0%	0%	6%
Information technology	3%	4%	2%	7%	2%	3%	3%	3%	2%
Technical sales, procurement, supply chain and logistics	7%	4%	5%	9%	10%	15%	15%	7%	4%
Technicians and technologists	3%	4%	3%	4%	4%	5%	5%	8%	7%
Trades	12%	17%	13%	8%	17%	10%	10%	20%	14%
Transport and heavy equipment operators	7%	17%	10%	2%	3%	4%	4%	0%	2%
Representation of the workforce	**80%**	**96%**	**70%**	**77%**	**83%**	**79%**	**79%**	**98%**	**99%**
Other occupations	**20%**	**4%**	**30%**	**23%**	**17%**	**21%**	**21%**	**2%**	**1%**

Percentages may not add up due to rounding.

Table 2: In-scope occupations included in each occupational group (NOC)

Business and operations support	Energy drilling, servicing and field operations	Engineers	Facility operations	Geoscientists
• Professional occupations in business management consulting (11201) • Professional occupations in advertising, marketing and public relations (11202) • Court reporters, transcriptionists, records management technicians and statistical officers (1211) • Survey, statistical and data entry occupations (1411) • Public and environmental health and safety professionals (2112) • Non-destructive testers and inspectors (22230) • Engineering inspectors and regulatory officers (22231) • Occupational health and safety specialists (22232) • Construction inspectors (22233) • Natural and applied science policy researchers, consultants and program officers (41400) • Economists and economic policy researchers and analysts (41401) • Business development officers and market researchers and analysts (41402) • Social policy researchers, consultants and program officers (41403)	• Managers in natural resources production (80010) • Contractors and supervisors, oil and gas drilling and services (82021) • Oil and gas well drillers, servicers, testers and related workers (83101) • Oil and gas well drilling and related workers and services operators (84101) • Oil and gas drilling, servicing and related labourers (85111)	• Engineering managers (20010) • Civil engineers (21300) • Mechanical engineers (21301) • Electrical and electronics engineers (21310) • Chemical engineers (21320) • Industrial and manufacturing engineers (21321) • Metallurgical and materials engineers (21322) • Mining engineers (21330) • Geological engineers (21331) • Petroleum engineers (21332)	• Chemists (21101) • Facility operation and maintenance managers (70012) • Trades helpers and labourers (7511) • Managers in manufacturing and utilities (9001) • Supervisors, petroleum, gas and chemical processing and utilities (92011) • Utilities equipment operators and controllers (9210) • Central control and process operators in processing and manufacturing (9310) • Chemical plant machine operators (94110) • Machine operators and related workers in food, beverage and associated products processing (9414) • Labourers in processing, manufacturing and utilities (9510)	• Geoscientists and oceanographers (21102)

Table 2: In-scope occupations included in each occupational group (NOC) - Continued

Information technology	Technical sales, procurement, supply chain and logistics	Technicians and technologists	Trades	Transport and heavy equipment operators
• Computer and information systems managers (20012) • Data scientists (21211) • Computer and information systems professionals (2122) • Computer, software and web designers and developers (2123) • Computer engineers (except software engineers and designers) (21311) • Technical occupations in computer and information systems (2222)	• Purchasing managers (10012) • Procurement and purchasing agents and officers (12102) • Production and transportation logistics coordinators (13201) • Supply chain logistics, tracking and scheduling coordination occupations (1440) • Corporate sales managers (6001) • Technical sales specialists in wholesale trade and retail and wholesale buyers (6210) • Retail sales persons and non-technical wholesale trade sales and account representatives (6410) • Customer and information services representatives (6440) • Material handlers (75101)	• Architects, urban planners and land surveyors (2120) • Chemical technologists and technicians (22100) • Geological and mineral technologists and technicians (22101) • Technical occupations in architecture, drafting, surveying, geomatics and meteorology (2221) • Civil engineering technologists and technicians (22300) • Mechanical engineering technologists and technicians (22301) • Industrial engineering and manufacturing technologists and technicians (22302) • Electrical and electronics engineering technologists and technicians (22310)	• Industrial instrument technicians and mechanics (22312) • Construction managers (70010) • Contractors and supervisors, technical industrial, electrical and construction trades and related workers (7201) • Contractors and supervisors, technical maintenance trades and heavy equipment and transport operators (7202) • Machinists and machining and tooling inspectors (72100) • Boilermakers (72103) • Welders and related machine operators (72106) • Electricians (except industrial and power system) (72200) • Industrial electricians (72201) • Plumbers, pipefitters and gas fitters (7230) • Insulators (72321) • Construction millwrights and industrial mechanics (72400) • Heavy-duty equipment mechanics (72401) • Automotive service technicians (7241) • Crane operators (72500)	• Managers in transportation (70020) • Transport truck drivers (73300) • Heavy equipment operators (73400) • Transport equipment operators, utility maintenance and related maintenance workers (7420)

Labour market modelling methodology

CIE's labour market modelling system produces the following for each in-scope sector and occupation:

- Hiring due to industry activity
- Hiring due to age-related attrition (retirements and deaths)
- Labour supply projections and supply and demand gap analysis

Hiring due to industry activity

In order to determine employment over a forecast period, CIE's modelling begins with "baseline" employment numbers derived from Statistics Canada and direct industry surveys and then uses "employment drivers" such as energy industry spending and production forecasts to determine the level of industry activity that will occur in a given year and the workforce that will be needed to support it. The model considers this for each in-scope sector and occupation, also allowing for adjustments to labour productivity at a sector level.

Determining baseline employment

Baseline employment data for in-scope established energy sectors is derived from Statistics Canada. The primary source of industry employment and labour force data is the 2021 Census of Canada. In addition, the data are calibrated with that published by Statistics Canada in the Labour Force Survey (LFS). This procedure allows ongoing monitoring of the performance of the labour market in the established energy sectors as LFS data is published monthly while census data is published every five years. Each sector is categorized under the North American Industry Classification System (NAICS)[2], so determining baseline employment begins with the corresponding NAICS code. Table 3 outlines where adjustments were required.

Table 3: Methodology for determining baseline employment, established sectors

Established energy sector	Corresponding NAICS code	Adjustment
Conventional E&P	211 Oil and gas extraction	Conventional E&P baseline employment is total oil and gas extraction industry employment minus estimated oil sands employment.
Oil sands	211 Oil and gas extraction	Oil sands employment is estimated directly from a headcount survey conducted by CIE in 2016. Workforce data was collected by facility-type: mining, in situ and upgrading.
Energy services	213 Support activities for mining, and oil and gas extraction	The share of mining employment is estimated using inter-industry expenditure data from Statistics Canada input-output accounts and removed from total support activities for mining, and oil and gas extraction employment.
Pipelines	486 Pipeline transportation	No adjustment required.
Refining petroleum	324 Petroleum and coal product manufacturing	Petroleum refineries employment is proportioned from the LFS employment for NAICS 324 using information from Statistics Canada's input-output accounts and weekly earnings by industry data.

Estimating baseline employment for the in-scope emerging sectors in CIE's newly expanded model required a different approach. Biomass-based fuels and low-carbon hydrogen are part of a larger NAICS code so employment for these sectors cannot be isolated from the broader industry. LNG and CCS are also relatively new sectors in the Canadian economy and employment data is not yet available through Statistics Canada. Table 4 outlines how baseline employment was estimated for CIE's in-scope emerging sectors.

Table 4: Methodology for determining baseline employment, emerging sectors

Emerging energy sector	Corresponding NAICS code	Adjustment
Biomass-based fuels	3251 Basic chemical manufacturing	Used secondary sources to estimate Canadian biomass-based fuels employment and aligned occupational share with basic chemical manufacturing; validated with industry.
Low-carbon hydrogen	3251 Basic chemical manufacturing	Used secondary sources to estimate Canadian low-carbon hydrogen employment and aligned occupational share with basic chemical manufacturing; validated with industry.
LNG	n/a	Used research previously conducted by CIE to estimate workforce requirements by occupation for one liquefaction train; validated with industry.
CCS	n/a	Used secondary sources to estimate Canadian CCS employment; validated with industry.

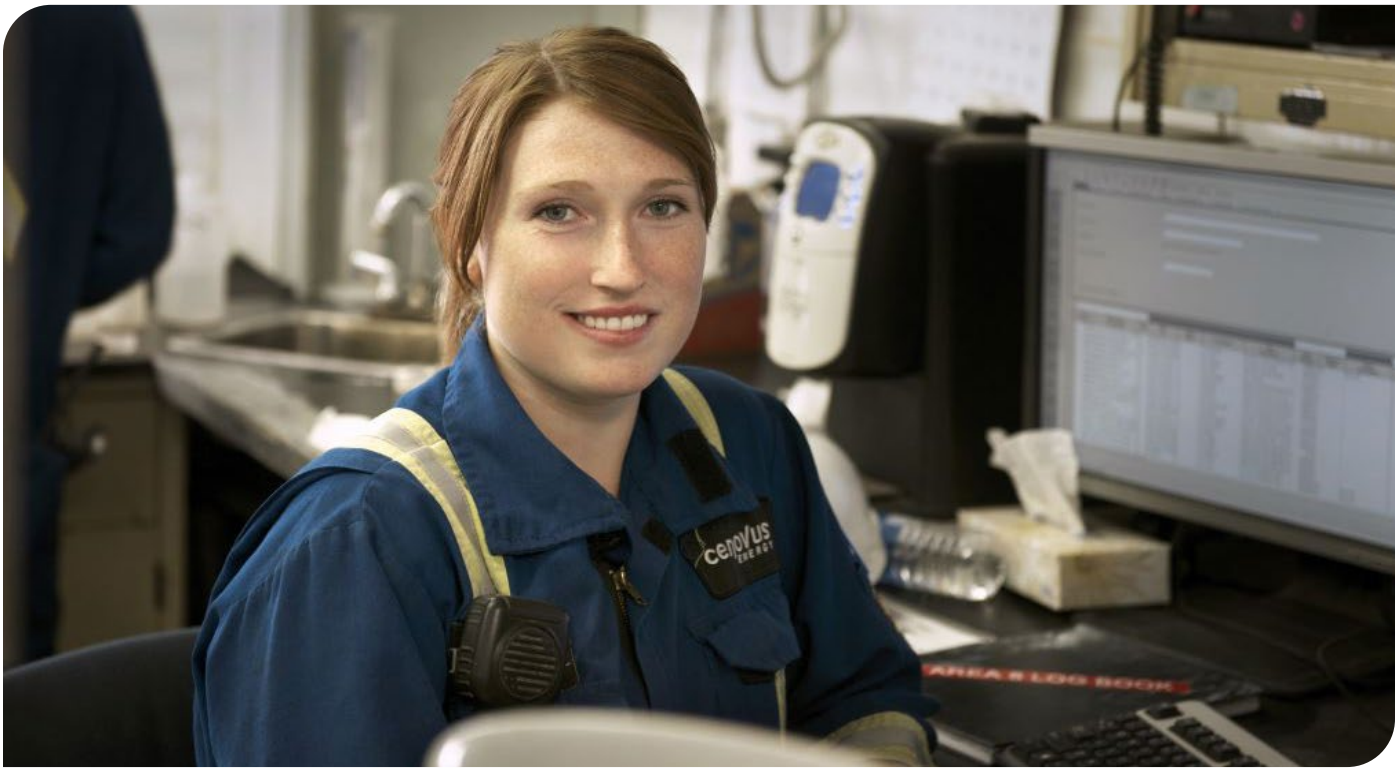


Photo courtesy of Cenovus

Hiring due to industry activity by occupation

CIE's labour demand models project an occupation's growth using its relationship to industry employment drivers (Table 5). Employment drivers are quantifiable data that is recognized as leading and/or lagging indicators of job generation. In the energy sector, these include capital and operating spending and production. The impact of these employment drivers vary depending on the sector.

CIE's model also has the ability to adjust for labour productivity changes at the sector level. A standard 1% annual productivity improvement is built into the modelling system. However, based on consultation with industry representatives, if they are seeing higher or lower shifts in productivity, adjustments are made. Technology adoption and mergers and acquisitions are examples of the kinds of drivers often behind labour productivity changes.

Determining industry activity and quantifying employment drivers for each sector

To project occupational requirements due to industry activity, employment drivers for each sector need to be quantified yearly for the forecast period. Due to variables that can impact the energy industry's activity levels, CIE often takes a scenario approach for quantifying employment driver data and projecting workforce requirements.

CIE works with industry representatives across all in-scope sectors to define industry activity scenarios. Economic forecasters and energy modellers, working with CIE, then translate and quantify the industry activity scenarios into year-over-year employment driver data. Secondary sources such as those available through industry associations, Canada Energy Regulatory (CER) and Environment and Climate Change Canada (ECCC) are also leveraged to determine industry activity and quantify employment drivers.

Table 5: Employment drivers for each in-scope energy sector as of 2023

Energy sector	Employment drivers
Conventional E&P	• Conventional E&P capital expenditures (CAPEX) • Conventional E&P operational expenditures (OPEX)
Oil sands	• Oil sands CAPEX (by facility-type: mining, in situ and upgrading) • Oil sands production (by facility-type: mining, in situ and upgrading)
Energy services	• Conventional E&P CAPEX • Conventional E&P OPEX • Oil sands CAPEX • Oil sands OPEX
Pipelines	• Conventional E&P OPEX and oil sands OPEX as a proxy for production
Petroleum refining	• Refined petroleum products production
Biomass-based fuels	• Biomass-based fuels production
Low-carbon hydrogen	• Low-carbon hydrogen production
LNG	• Workforce requirements per liquefaction train
CCS	• Workforce requirements based on project configuration (carbon capture units, pipeline transportation and sequestration)

CIE's *National and Regional Labour Market Outlooks to 2035* considered two scenarios to project a potential range of workforce requirements to 2035. More details on the scenarios can be found at www.CareersinEnergy.ca.

Hiring due to age-related attrition

Hiring required to fill positions vacated by workforce retirements and natural deaths is referred to as age-related attrition.

To calculate hiring due to age-related attrition, CIE's model applies historical age-related attrition rates—based on an occupation's average retirement age and death rate—to the age demographic of each in-scope occupation in each sector. The resulting calculation is a yearly age-related attrition forecast for each occupation and an indication of the potential number of age-related attrition job openings for each occupation in each sector. Adding up the projected age-related attrition for each occupation provides projected age-related attrition and potential job vacancies at a sector level.

Labour supply projections and supply and demand analysis

CIE's labour supply model looks at three potential sources of labour supply:

- New entrants: age groups 15-24 years and 25-34 years representing those entering the labour force for the first time after receiving an education
- Workers transitioning into the energy sector from other industries
- International immigration

Labour supply for the energy industry is dependent upon a number of factors, including competition from other industries. In modelling the energy industry's labour supply, CIE starts with the industry's historical share of Canada's labour supply and then calculates the industry's potential supply based on its ability to attract its share of workers.

However, even if the industry is able to attract its share of the labour supply, there may still be a shortfall. As mentioned, the labour force available for each occupation is impacted by age-related attrition so the talent pool may not be large enough to meet the needs of all industries that require it.

Labour supply and demand gap analysis

Labour supply and demand gaps are indicated as a comparison between an occupation's projected unemployment rate based on projected employment and labour supply and its "normal" unemployment rate. The normal unemployment rate for industry occupations that are not subject to seasonal demands are generally between 4% and 6%. Occupations that are subject to seasonal demands, such as many of those found in the energy services sector, generally have a higher "normal" unemployment rate of between 7% and 9%.

If an occupation's projected unemployment rate falls below its normal unemployment rate, CIE's model projects a labour shortage. If an occupation's projected unemployment rate is above its normal unemployment rate, a surplus of talent is forecasted.

CIE's *National Labour Market Outlook to 2035* anticipates labour shortages across all in-scope occupations at some point over the forecast period. The report specifically identifies occupations projected to experience "significant" labour supply and demand gaps—defined as those where the gap between total projected unemployment and total normal unemployment rates for the forecast period are greater than 4%.

Endnotes

[1] Government of Canada. (2019, March 1). *National Occupation Classification*. Canada.ca. https://noc.esdc.gc.ca/?GoCTemplateCulture=en-CA

[2] Government of Canada, Statistics Canada. (2023, June 1). *North American Industry Classification System (NAICS) Canada 2022 Version 1.0*. https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=1369825

Acknowledgements and Disclaimer

The Careers in Energy division of Energy Safety Canada gratefully acknowledges the Government of Canada for the funding to undertake and complete this study.

Careers in Energy is also grateful for the time and expertise provided by the following organizations:

- Advanced Biofuels Canada
- Atlantica Centre for Energy
- Avatar Innovations
- Canadian Association of Energy Contractors (CAOEC)
- Canadian Fuels Association (CFA)
- Canadian Association of Geophysical Contractors (CAGC)
- Canadian Association of Petroleum Producers (CAPP)
- Carbon Management Canada (CMC)
- Enbridge Inc.
- Energy Futures Lab
- Enserva
- geoLOGIC systems Ltd.
- LNG Canada
- Myriad Consulting Inc.
- Pathways Alliance
- Precision Drilling Corporation
- Rystad Energy
- Shell Canada Ltd.
- Treeline Well Services LP.

Thank you to the following contributors who were essential to the development of this report:

- Creative Links International Inc.
- Stokes Economics
- Systematic Solutions Inc.
- Beanstalk Communications Inc.
- Mario Scaffardi Design Inc.

Copyright and Disclaimer

Published February 2024

For permissions requests or further inquiries, please contact:
Careers in Energy, a division of Energy Safety Canada

Phone:
403.516.8100

Email:
info@careersinenergy.ca

CareersinEnergy.ca

careers in™ energy

Division of Energy Safety Canada

About Careers in Energy

Careers in Energy, a division of Energy Safety Canada, is the leading authority on labour market information and trends in Canada's energy industry. We engage and inform people about careers in energy, removing barriers to information, addressing industry and worker needs, and providing the resources and tools needed to maintain and build a skilled energy workforce for today and tomorrow.

info@careersinenergy.ca

403.516.8100 or toll free 1.866.537.1230

150, 2 Smed Lane SE, Calgary, AB T2C 4T5

CareersinEnergy.ca

Canada Funded in part by the Government of Canada's Sectoral Workforce Solutions Program