Petroleum Labour Market Information

The Decade Ahead:

Labour Market Outlook to 2022 for Canada's Oil and Gas Industry

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THE DECADE AHEAD: LABOUR MARKET OUTLOOK TO 2022 FOR CANADA'S OIL AND GAS INDUSTRY

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EXECUTIVE SUMMARY

Canada's oil and gas industry continued to attract investment throughout 2012. In addition to considerable interest and investment in exploring the potential for liquefied natural gas (LNG) exports from British Columbia, there was an acceleration of oil sands development in Alberta. Saskatchewan saw growth in light and heavy oil production. In Nova Scotia, Deep Panuke offshore gas project is expected to be in production later this year. In Newfoundland and Labrador, the Hebron offshore oil project moved into the development and construction phase, and is targeted for production in 2017.

Looking to the future, downside risks are also evident. Horizontal drilling and hydraulic fracturing is unlocking previously inaccessible natural gas and conventional oil and has allowed energy producing countries, including Canada's primary customer, the United States (US), to reverse declining oil and gas production. Canada's oil and gas industry is at a critical turning point and it is increasingly clear that, with only a short window of opportunity, market diversification and a greater global presence are critical to sustainable growth within Canada's oil and gas industry.

The development of a LNG export sector would transform the nation's natural gas industry. Producers and pipeline companies are looking into the feasibility of shipping oil to refineries in Eastern Canada. With the reversal and/or reconfiguration of pipelines, Canada's east coast could also become the gateway for oil exports to European, Indian and Asian markets. Oil from Western Canada would increase the profitability of refineries that currently rely on more expensive imported oil and would sustain, if not increase, employment in Ontario, Quebec and the Atlantic provinces.

CANADA'S OIL AND GAS WORKFORCE DEMAND

In 2012, direct employment within the upstream and midstream petroleum sector is estimated to be 195,200 workers. Employment is projected to increase over the next decade, but growth will be limited if market diversification does not occur.

This report considers two potential scenarios:

- **Low Growth:** market diversification does not occur and industry growth is driven by North American demand for oil and natural gas from industrial uses, power generation and transportation.
- **Expansion:** market diversification occurs and Canadian oil and gas producers supply international markets. A debottleneck and expansion of oil pipeline capacity will contribute to industry growth, as will the development of LNG export facilities and associated pipelines.

Depending on which scenario unfolds, employment over the next decade may increase between nine and 20 per cent respectively, with employment levels reaching 213,500 to as much as 233,900 by 2022.

INVESTMENTS AND ACTIVITIES BY THE OIL AND GAS INDUSTRY BENEFITS ALL CANADIANS

Over the next decade, forecasted investment and activity levels in Canada's oil and gas industry are projected to sustain an annual average of 894,100 to 1,036,100 direct, indirect and induced jobs coast-to-coast. While 80 per cent of the jobs will be in Western Canada, a number of jobs will also be supported in other regions including Ontario, Newfoundland and Labrador, Quebec, Nova Scotia and Manitoba.

- Approximately 21 per cent of the total workforce will be in direct jobs in exploration and production, oil and gas services and pipeline operations.
- Almost half (49 per cent) of the jobs will be for the indirect workforce particularly in construction, manufacturing, transportation and warehousing, and other contracted services.
- The remaining 30 per cent will be for 'induced' jobs which are driven largely through a general increase in consumer spending by direct and indirect workers.

Three key factors will drive demand for direct oil and gas workers over the next ten years including:

- industry activity levels
- age-related attrition
- workforce competition

Hiring Due to Industry Activity Levels

Canada's oil and gas industry will add jobs over the next decade, regardless of the activity scenario. In the Low Growth scenario, the industry adds just under 18,300 jobs while in the Expansion scenario, the industry adds 38,700 jobs.

The difference in direct new jobs created between the two scenarios is 20,400 jobs – reflecting the loss of job opportunities if market diversification does not occur. Unfortunately, the drawbacks continue as with every job created within the oil and gas industry, three jobs are created outside of the industry.

Hiring Due to Age-Related Attrition

Over the next decade, 23 per cent of the industry's workforce will become eligible to retire and the industry may need to fill between 44,200 and 45,300 job vacancies due to age-related attrition.

Hiring Due to Workforce Competition

The intense competition for talent within and outside of the industry creates additional job openings. A three per cent non-retirement turnover rate significantly increases the number of job vacancies industry will need to fill, adding 62,600 and 65,800 job openings respectively in the Low Growth and Expansion scenarios between 2013 and 2022.

Over the next decade, **total hiring for direct oil and gas jobs ranges between 125,000 and 150,000** due to industry activity, age-related attrition and non-retirement turnover.

Labour and Skill Shortages

The oil and gas industry is already dealing with labour supply/demand gaps. For both scenarios, there is no relief in sight as projected industry unemployment rates fall below a balanced labour market beginning in 2013 and industry-wide shortages persist throughout the outlook period. In addition, the severe labour and skill shortages experienced in 2007 is expected to return by 2014 when the industry unemployment rate falls to around five percent in either scenario.

Regardless of scenario, the industry will experience a tight labour market for a number of occupations including:

- Engineers: project, mining electrical/ instrumentation, chemical, mechanical, petroleum, and civil
- Mechanical and instrumentation engineering technologists, drafting technologists and technicians
- Environmental and non-destructive testers and inspection technicians
- Power engineers (steam-ticket operators)
- Drilling coordinators/production managers
- Oil and gas field workers, labourers and operators
- Trades: instrumentation technicians, heavy-duty equipment mechanics, welders, insulators, crane operators, millwrights and machinists, steamfitters and pipefitters

Sector Analysis

Each industry sector will face unique workforce challenges over the next decade. The following summarizes net hiring requirements – or hiring due to industry activity and age-related attrition (excluding non-retirement turnover) for each:

Oil and Gas Services

Employment within the oil and gas services sector (i.e., drilling and completions, geophysical, and petroleum services) is projected to increase in either scenario. If market diversification occurs, the sector's employment will further increase to meet growing demands for production from oil sands, shale oil and gas and the development of the LNG export sector.

Over the next decade, the sector will need to fill between 37,700 and 47,900 job openings due to industry activity and age-related attrition (Low Growth and Expansion scenarios respectively).

Exploration and Production (E&P)

Great opportunities exist around LNG export development, oil sands developments and expanded offshore activities. However, significant investment from the E&P sector (i.e., conventional E&P activity and oil sands operations) is required as these developments are very expensive and require long lead times.

Despite a decline in the total number of conventional E&P jobs, oil sands operations will require significant hiring. Age-related attrition will create a number of job vacancies for both sectors. It is expected that between 6,850 and 10,700 job openings in conventional E&P and between 14,900 and 22,200 in oil sands operations will need to be filled due to industry activity and age-related attrition (Low Growth and Expansion scenarios respectively).

Pipelines

Several thousand kilometers of new pipelines are required to realize market diversification. The construction phase of the pipeline expansion will be significant and the labour requirements will be intensive. In comparison, pipeline operations require fewer employees than the construction phase. However, when combined with hiring due to age related attrition; the sector's net hiring requirements to 2022 is between 3,000 and 3,250 jobs (Low Growth and Expansion scenarios respectively).

Occupations with Greatest Net Hiring Requirements to 2022, by Petroleum Sector

(Low Growth – Expansion Scenarios)

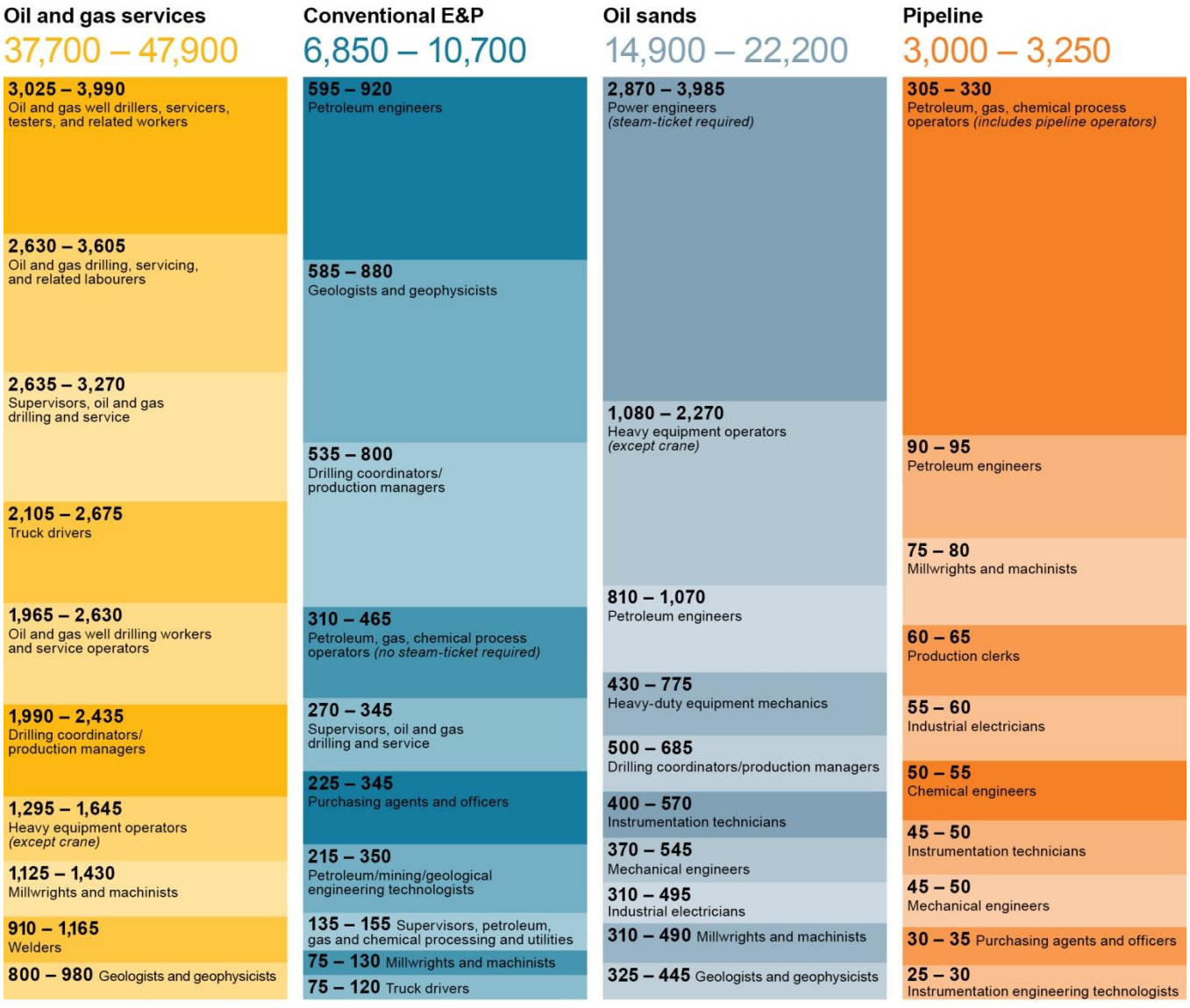

FIG. 1

PROVINCIAL ANALYSIS

British Columbia (BC): Foreign investment and the province's liquids-rich natural gas plays have kept BC's industry busier than expected, especially considering the low natural gas price environment.

In the Low Growth scenario, where increased demand is from domestic sources, BC-based employment only grows by 640 jobs to 2022. In the Expansion scenario, where the development of a BC-based LNG export[1] industry is realized, the projected employment growth is 1,600 jobs to 2022.

Projected net hiring for BC's oil and gas industry is between 3,100 and 4,100 jobs (Low Growth and Expansion scenarios respectively).

Net Hiring Requirements to 2022 for Top Ten BC-based Oil and Gas Occupations
(Low Growth – Expansion Scenarios)

285 – 410	Oil and gas well drillers, servicers, testers, and related workers
225 – 355	Oil and gas drilling, servicing, and related labourers
245 – 315	Supervisors, oil and gas drilling and service
225 – 300	Truck drivers
180 – 265	Oil and gas well drilling workers and service operators
180 – 230	Drilling coordinators/production managers
145 – 185	Petroleum, gas, chemical process operators *(no steam-ticket required)*
135 – 180	Heavy equipment operators *(except crane)*
130 – 175	Millwrights and machinists
95 – 130	Welders

FIG. 2

Alberta: Technology is having a significant impact on the province's oil and gas production potential. A decade ago, it was believed that the industry would be focused on harvesting from a mature basin.[2]

Today, everything old within Alberta's conventional industry is new again, as technology is allowing companies to undertake new exploration and rework old wells. Alberta's oil sands are expected to expand at a sustainable rate.

However, the industry's ability to realize the full benefits of technological advancements and oil sands development is still hindered by pipeline capacity and a single customer (US).

Alberta's oil and gas industry will need to fill between 53,800 and 72,700 job openings (Low Growth and Expansion scenarios respectively).

Net Hiring Requirements to 2022 for Top Ten Alberta-based Oil and Gas Occupations
(Low Growth – Expansion Scenarios)

2,925 – 4,075	Power engineers *(steam-ticketed operators)*
2,110 – 3,575	Heavy equipment operators
2,585 – 3,350	Drilling coordinators/production managers
2,305 – 3,065	Oil and gas well drillers, servicers, testers, and related workers
2,320 – 2,865	Supervisors, oil and gas drilling and service
1,920 – 2,700	Oil and gas drilling, servicing, and related labourers
1,920 – 2,605	Petroleum engineers
1,690 – 2,140	Truck drivers
1,510 – 2,040	Geologists and geophysicists
1,465 – 2,000	Oil and gas well drilling workers and service operators

FIG. 3

Saskatchewan: Growth of the province's oil industry is driven by increased activity in the prolific Bakken shale oil formation where technology is reversing the decline in light oil production. Technology is also impacting activity around Lloydminster as the industry is applying thermal technology to enhance heavy oil production in the area.

With the increased use of rail to address pipeline capacity issues, activity is expected to increase over the next couple of years, regardless of scenario.

Saskatchewan-based net hiring to 2022 is between 2,600 and 3,450 job openings (Low Growth and Expansion scenarios respectively).

Net Hiring Requirements to 2022 for Top Ten Saskatchewan-based Oil and Gas Occupations
(Low Growth – Expansion Scenarios)

230 – 330	Oil and gas well drillers, servicers, testers, and related workers
170 – 275	Oil and gas drilling, servicing, and related labourers
220 – 275	Supervisors, oil and gas drilling and service
190 – 250	Truck drivers
140 – 210	Oil and gas well drilling workers and service operators
155 – 190	Drilling coordinators/production managers
135 – 170	Petroleum, gas, chemical process operators *(no steam-ticket required)*
115 – 150	Heavy equipment operators *(except crane)*
110 – 150	Millwrights and machinists
80 – 105	Welders

FIG. 4

Rest of Canada: Currently, the majority of oil and gas activity in the rest of Canada takes place in Manitoba's oil production from the Bakken shale oil formation, Nova Scotia's offshore natural gas and Newfoundland and Labrador's offshore oil.

Nova Scotia's second offshore natural gas production facility (Deep Panuke) is expected to be in production later this year. Newfoundland and Labrador's fourth offshore oil project, Hebron, is currently being developed.

Technology has increased the potential of industry expansion across Canada, including the development of shale oil and gas deposits and LNG exports from Canada's east coast.

Over the next decade, between 2,900 and 3,750 job openings will need to be filled within the rest of Canada (Low Growth and Expansion scenarios respectively).

Net Hiring Requirements to 2022 for Top Ten Oil and Gas Occupations in Rest of Canada
(Low Growth – Expansion Scenarios)

145 – 185	Supervisors, oil and gas drilling and service
125 – 175	Oil and gas well drillers, servicers, testers, and related workers
135 – 175	Drilling coordinators/production managers
130 – 155	Petroleum, gas, chemical process operators *(no steam-ticket required)*
95 – 150	Oil and gas drilling, servicing, and related labourers
105 – 140	Truck drivers
95 – 125	Petroleum engineers
75 – 115	Oil and gas well drilling workers and service operators
75 – 105	Geologists and geophysicists
75 – 95	Millwrights and machinists

FIG. 5

WORKFORCE SOLUTIONS

Given the global competitiveness for skilled workers, industry stakeholders need demand-driven solutions to increase the talent pool for the oil and gas industry within Canada. Connecting Canadians with available jobs should be a top priority. From there, international recruitment and economic immigration programs can help to meet specific workforce needs. Key solutions include:

- source labour supply from provinces with higher unemployment rates
- enhance mobility of transferable skills and qualifications across industries and across Canada
    - companies can offer rotational schedules and accommodation and transportation support that are attractive to workers from across Canada
- develop a more effective and efficient education and training system
- increase energy literacy and career awareness across Canada
- increase use and completion of apprenticeship programs
- utilize the Temporary Foreign Worker program for temporary or shorter-term assignments and economic immigration programs for labour and skill shortages within industry-specific occupations
- collaborate and commit to ongoing dialogue and development of innovative workforce solutions

A sustainable oil and gas industry is in the best interests of Canada as whole. The industry is poised for growth, but to achieve its potential a number of risks must be addressed to help alleviate uncertainty. From a business perspective, Canada needs to transport its landlocked oil and natural gas resources to its coasts and to global markets. From a workforce perspective, the industry needs to continue to work with governments, education and training institutions and employment organizations to increase the pool of Canadian workers qualified to work in oil and gas.

Resolving current workforce shortages, as well as preparing for the future, is critical to the industry's longer-term sustainability and success.

INTRODUCTION

Canada has extensive oil and natural gas resources coast to coast with activity in 12 out of 13 provinces and territories. Canada is the third largest producer of natural gas, the fifth largest energy producer and the sixth largest producer of crude oil in the world. Also, Canada has the third-largest global reserves of oil, behind Venezuela and Saudi Arabia.[3]

Canada's oil and gas industry continued to attract investment throughout 2012, resulting in an acceleration of oil sands development, especially in situ operations. The past year also realized considerable interest and investment in the development of a liquefied natural gas (LNG) export sector in northwestern British Columbia. In Nova Scotia, Deep Panuke offshore gas project is currently being installed and is expected to be in production later this year. In Newfoundland and Labrador, the Hebron offshore oil project moved into the development and construction phase, and is expected to start production in 2017.

A more stable business environment has been created with an increase in joint ventures with Asian companies who are investing in Canada as part of their long-term strategies to secure energy. This increased foreign investment has allowed Canada's oil and gas industry to take a longer-term view of its exploration and development plans.

Sustainable growth of Canada's oil and gas industry is key to the overall health of the economy. By 2012, direct employment is estimated to be over 195,200 people, adding at least 2,200 jobs from the previous year and about 18,200 jobs (or 10 per cent) from 2009 employment levels.

Canada's Oil and Gas Industry Employment from 2009 to2012, by Petroleum Industry Sector

Industry Sector	2009 Actual	2011 Actual	2012 Estimate	Net Change (2011-2012)
Oil and gas services	82,900	90,400	94,100	3,700 (+4%)
Conventional E&P	69,900	75,600	72,000	-3,600 (-5%)
Oil sands	17,700	20,300	22,300	2,000 (+10%)
Pipelines	6,500	6,700	6,800	100 (+1%)
Total	**177,000**	**193,000**	**195,200**	**2,200 (+1%)**

FIG. 6 *Data sourced from labour force survey (LFS) and industry surveys; numbers have been normalized and rounded.*

Canada as a whole benefits from a growing oil and gas industry. Oil and gas activities and investments sustain indirect jobs coast-to-coast in:

- construction
- manufacturing
- transportation and warehousing
- professional, scientific and technical services
- waste management and remediation services, and
- financial, insurance, real estate and rental and leasing.

Jobs will also be supported or 'induced' in the broader economy, largely through a general increase in consumer spending by direct and indirect workers.

AN INDUSTRY AT A TURNING POINT

Looking ahead, downside risks are evident and it is increasingly clear that market diversification and a greater global presence are critical to sustainable growth within Canada's oil and gas industry.

There is tremendous potential for continued growth within Canada's oil and gas industry, but uncertainty also exists. In order to grow, the industry needs to diversify its customer base.

The widespread use of horizontal drilling and hydraulic fracturing has unlocked natural gas and conventional oil reserves and has allowed energy producing countries including Canada's primary customer, the United States (US) to reverse once-declining

production of oil and gas. These developments are bringing Canada's oil and gas industry to a critical turning point. Industry and governments are looking to solutions for market diversification and an increased global presence for its oil and natural gas, but there is a relatively short window of opportunity.

The dynamic tension between opportunity and uncertainty was evident as 2012 came to a close and a few natural gas focused companies announced employee layoffs in early 2013.

Natural Gas – The Race is On

There is opportunity to grow natural gas demand domestically through increased use of oil and gas for power generation and in the transportation sector. The industry itself has increased its use of natural gas in the oil sands by running drilling rigs and converting fleet vehicles to compressed natural gas (CNG). **The development of a liquefied natural gas (LNG) export sector is a much-needed game changer for Canada's gas producers.** Time is of the essence as a global race is on to supply Asian and other developing countries with LNG products.

As of February 2013, six LNG export projects have been announced for northwestern BC. LNG exports from Canada's west coast offer potential Asian markets many benefits including:

- secure supply of natural gas from a politically stable country
- shorter and therefore cheaper routes to Asia-Pacific markets
- colder climates assist with a more efficient liquefaction process
- opportunity to diversify sources of natural gas

While Canada's LNG exports offer potential customers many benefits, they also face tremendous competition from countries such as Australia, Trinidad, East Africa, Egypt and the US. Specific challenges include:

- In China, LNG is also competing with natural gas that can be transported by pipeline from Russia.
- Increasing demand for Canada's natural gas requires infrastructure including pipelines, LNG export facilities and LNG/CNG filling stations. These are expensive decisions that require careful consideration by project developers.
- There are a limited number of suitable LNG plant sites and the terrain that the associated pipelines must cross is very rugged.
- As a new sector in Canada, domestic fiscal and regulatory frameworks are not in place for exporting LNG. These need to be solidified before proponents will make final investment decisions.

Oil – Opportunities Exist with Changes Ahead

Pipelines are planned to deliver Canadian oil to the US and Asia however, modifications to existing pipelines are also options for market diversification. There is opportunity to convert underutilized natural gas pipelines going east to transport oil to eastern Canadian ports and on to global markets. Pipelines currently moving oil east to west could also be reversed to establish a gateway for oil exports to Europe, India and Asia.

Refineries in Ontario, Quebec and the Atlantic provinces could be reconfigured to process oil sands and heavy oil and narrow the negative price differential Canada currently receives for its oil compared to West Texas Intermediate (WTI) pricing. Increased delivery of Canadian oil production to eastern Canadian refineries decreases reliance on more expensive imported oil and increases the profitability of Canadian refineries.

Finally, the oil industry has a renewed demand for rail services, offering an alternative transportation method. Although more costly, railways have become a popular option for dealing with short-term oil pipeline capacity constraints by delivering Canadian oil production to ports for export or to refineries on the Gulf coast.

Workforce Issues and Opportunities

Skill shortages are also a risk to the industry's sustainability. Competition for experienced workers is expected to be fierce. Just as industry and government are looking for market diversification solutions, **demand-driven solutions for workforce concerns are also required to develop a larger pool of qualified workers.** Previous calls for collaborative approaches to addressing Canada's oil and gas workforce issues are translating into action. Collaborative strategies and plans led by industry associations and provincial governments are a step in the right direction.

Some collaborative examples include:

- establishment of a natural gas workforce strategy committee to assess labour demand and workforce issues associated with the development of an LNG export sector in BC
- collaboration between industry and post-secondary institutions in Alberta to develop and implement a water treatment operator program that provides the skills and knowledge required for operations of complex water treatment in steam-assisted gravity drainage (SAGD) oil sands operations
- industry associations, led by the Canadian Association of Petroleum Producers (CAPP), completed a comprehensive review of current oil and gas related workforce initiatives with the goal of formulating a strategic response to address projected skill shortages

While poised for growth and expansion, the industry must address key issues around market diversification, infrastructure, the environment and supply of skilled workers to minimize risk and uncertainty.

Scope

The Decade Ahead: Labour Market Outlook to 2022 for Canada's Oil and Gas Industry provides an in-depth analysis of industry's workforce challenges and opportunities, both in the short-term to 2015, as well as long-term to 2022. The labour market projections outlined and analyzed in the report include:

- Employment outlook
- Hiring requirements due to industry activity, age-related attrition, and workforce competition
- Labour shortages

Aside from the overall outlook for the industry, outlooks are provided by petroleum industry sectors:

- **Oil and gas services** sector includes:
  - drilling and completion services, including drilling and service rig activities
  - geophysical services (also known as seismic) including surveying, permitting and reclamation, line construction, drilling and data acquisition
  - petroleum services, including well services, oilfield construction and maintenance, production and transportation services
- **Exploration and production (E&P)** sector includes the following:
  - Conventional E&P activity encompasses the exploration and production of oil and gas for all onshore and offshore conventional and unconventional reserves (except oil sands) including:
    - liquids-rich natural gas, tight oil and gas, shale oil and gas, heavy oil, etc.
    - natural gas processing
  - Oil sands involves the extraction, production and upgrading of bitumen. There are three types of oil sands activity:
    - mining: activities to explore and recover oil sands reserves through open pit mines
    - in situ: activities to explore and recover oil sands reserves in place or in situ, by drilling wells
    - upgrading: converting bitumen into a product with a lower density and viscosity
- **Pipeline** sector involves the storage and mainline transmission of oil and gas.

Finally, outlooks are also provided for Canada's three largest energy-producing provinces, British Columbia (BC), Alberta and Saskatchewan, as well as the rest of the country.

For the first time, *The Decade Ahead* provides insights into the indirect and induced employment generated by oil and gas investment in Canada. This information is reported for Canada as a whole, as well as by province.

The qualitative analysis and insight in this report are intended to inform industry stakeholders and assist with the development and implementation of effective workforce plans and strategies.

LABOUR MARKET OUTLOOK: KEY FINDINGS AND ANALYSIS

INDUSTRY-WIDE HIRING OUTLOOK

As mentioned previously in this report, three key factors will drive industry hiring needs:

- industry activity levels
- age-related attrition
- workforce competition

Each factor will be analyzed in detail for two scenarios based on a range of potential oil and gas prices, capital and operating expenditure forecasts, and oil sands production forecasts.[4]

The first scenario is the **Low Growth scenario** where market diversification does not occur and industry growth is driven by North American demand for oil and natural gas. With this outlook, there will be moderate increases to conventional oil and oil sands production, as well as a continued focus on liquids-rich natural gas. To drive growth, the industry will depend on increased North American demand for natural gas from various sources:

- oil sands and other industrial uses
- power generation – phasing out of coal-generated electricity
- transportation – use of natural gas as fuel by medium and heavy trucks

In the **Expansion scenario,** market diversification is expected to occur and Canadian oil and gas producers will supply to international markets. A debottleneck and expansion of oil pipeline capacity will contribute to industry growth, as will the development of LNG export facilities and pipelines.

Hiring Due to Industry Activity

In the Expansion scenario, the industry adds 38,700 jobs, while in the Low Growth scenario, the industry adds just under 18,300 jobs.

Canada's Oil and Gas Industry Employment Outlook to 2022

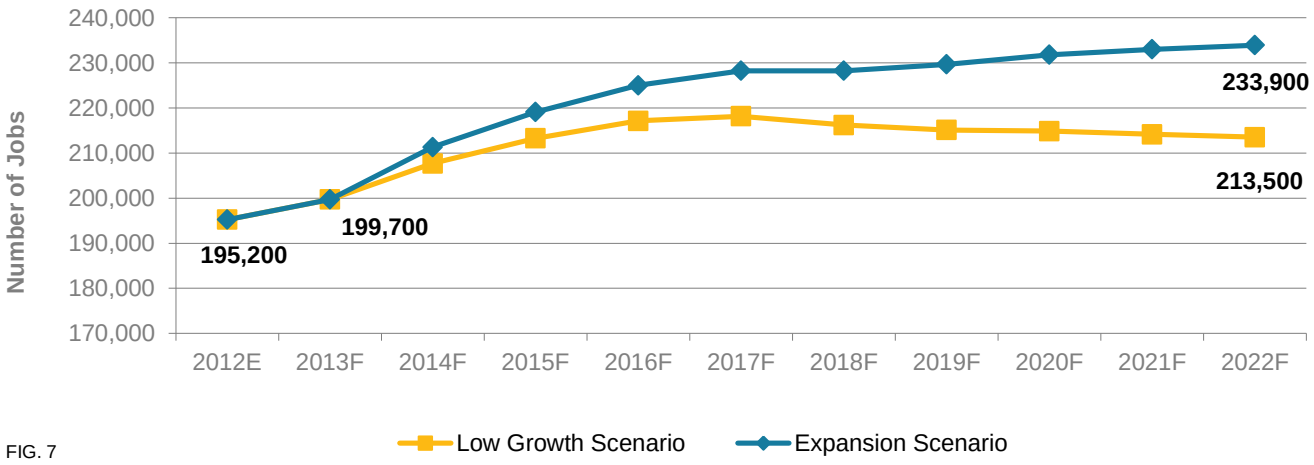

FIG. 7

Regardless of scenario, Canada's oil and gas industry will add jobs over the next decade.

EMPLOYMENT BENEFITS OF INVESTMENTS AND ACTIVITIES WITHIN CANADA'S OIL AND GAS INDUSTRY

The sizable cumulative investment in development and operations within Canada's oil and gas industry to 2022 is estimated to sustain an annual average of 894,100 to 1,036,100 direct, indirect and induced jobs across Canada (Low Growth and Expansion scenarios respectively). Although majority of the jobs are expected to be found in Western Canada (approximately 80 per cent employment share with Alberta employing close to 65 per cent of the total workforce), other provinces will also benefit from an employment perspective including Ontario, Quebec, Newfoundland and Labrador, Nova Scotia and Manitoba.

Between 2013 and 2022, the industry will sustain an average of 213,000 to 224,400 direct jobs each year in exploration and production, oil and gas services and pipeline operations.

In addition, between 413,400 and 505,300 indirect jobs will be sustained each year in:

- construction
- manufacturing
- transportation and warehousing
- professional, scientific and technical services
- waste management and remediation services
- financial, insurance, real estate and rental and leasing

Finally, an average of 267,700 to 306,400 jobs each year will also be supported or 'induced' in the broader economy, largely through a general increase in consumer spending by direct and indirect workers.

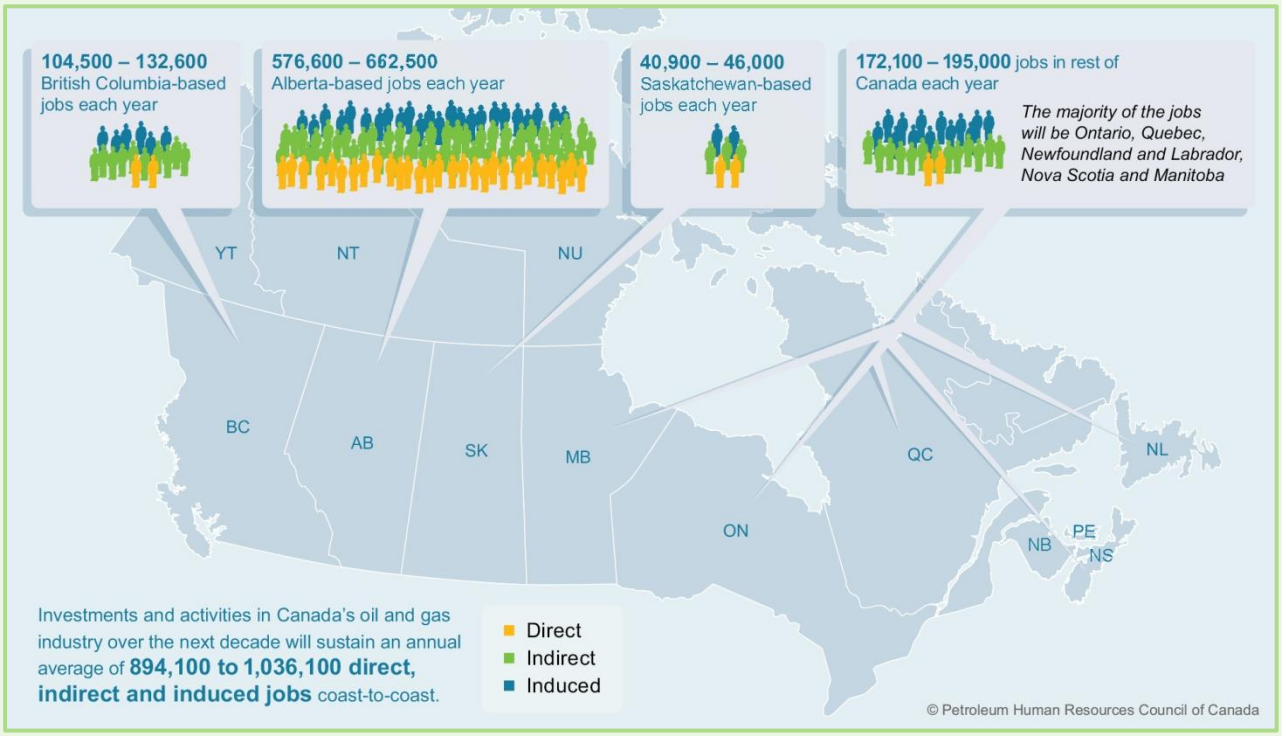

FIG. 8

Investments and activities of the oil and gas industry, including LNG development on the west coast, offshore oil and gas development on the east coast, and oil sands development in Alberta will continue to benefit all Canadians.

Hiring Due to Age-Related Attrition

Over the next decade, 23 per cent of the industry's workforce will become eligible to retire. The impact will be considerable, from a loss of experience and skills, with repercussions for workforce development and productivity. Between 44,100 and 45,300 workers are projected to retire in the Low Growth and Expansion scenarios respectively, creating a significant number of job vacancies.

Over the next decade, Canada's oil and gas industry will need to fill between 62,400 and 84,000 job openings due to industry expansion and workforce retirements.

There are a number of core oil and gas occupations with a rate of retirement greater than the industry average.

Occupation	Average Age of Labour Force	Age-related Attrition to 2022
Oil and Gas Industry As a Whole	**40**	**23%**
Supervisors, petroleum, gas and chemical processing and utilities	44	32%
Drilling coordinators/production managers	44	31%
Geologists and geophysicists	44	29%
Industrial engineering and manufacturing technologists and technicians	42	29%
Inspectors in public and environmental health and safety	42	29%
Purchasing agents and officers	42	28%
Supervisors, oil and gas drilling and service	43	27%
Non-destructive testers and inspection technicians	40	26%
Project engineers	41	25%
Petroleum engineers	42	25%
Petroleum/mining/geological engineering technologists	38	25%
Drafting technologists and technicians	40	25%
Industrial electricians	41	25%
Crane operators	42	25%
Civil engineers	42	24%
Electrical/instrumentation engineers	40	24%
Instrumentation engineering technologists	39	24%
Power engineers (or steam-ticketed operators)	38	24%

FIG. 9

Workforce retirements will impact industry hiring for the foreseeable future, as the annual age-related attrition rate for occupations needed by the oil and gas industry continues to increase. In 2007, annual age-related attrition was 1.5 per cent of total employment. In 2013, it is 2.1 per cent and will be 2.25 per cent by 2022.

Short- Versus Long-Term Net Hiring Outlook

A closer look at year-over-year net hiring requirements – or hiring due to industry activity and age-related attrition (excluding non-retirement turnover) – reveals a distinction between short-term (to 2015) and long-term (to 2022) workforce needs and the drivers behind each.

Short-term Net Hiring Outlook (2013 to 2015)

In both scenarios, short-term hiring due to industry activity outweighs the need to hire due to age-related attrition.

Regardless of scenario, hiring due to industry activity will be significant in the short-term and industry will need to fill between 18,000 and 23,900 new jobs created between 2013 and 2015 (Low Growth and Expansion scenarios respectively). During this period, oil sands projects currently under construction are expected to be completed, requiring operations staff and driving employment increases within the oil and gas services sector. It is very rare that projects and therefore staffing of projects are shelved once they move into the construction phase. Currently there are 20 oil sands projects of varying sizes under construction.[5] These projects will begin to hire operations employees and contract services from the oil and gas services sector, including the drilling and servicing of in situ wells, before 2015.

In an Expansion scenario, market diversification will drive job creation for the conventional E&P sector. New jobs in pipeline will also be created but will be the same in either scenario.

Hiring due to age-related attrition is just over 12,000 workers in either scenario and, when combined with hiring due to industry activity, results in industry needing to fill between 30,100 and 36,000 job openings between 2013 and 2015.

Long-term Net Hiring Outlook (2013 to 2022)

While the industry continues to add jobs beyond 2015, workforce demographics will drive the majority of industry net hiring requirements after 2015:

- In the Low Growth scenario, the conventional industry is severely impacted by lack of market diversification and job losses are barely offset by slower expansion in the oil sands. As a result, the industry adds only 250 jobs and age-related attrition will drive the majority of industry net hiring requirements with over 32,000 job openings.
- In the Expansion scenario, market diversification creates 14,800 new jobs but an additional 33,200 job openings will need to be filled as a result of age-related attrition.

After 2015, greater uncertainty exists as industry activity and employment growth is increasingly dependent upon market diversification.

Over the next decade, the industry will need to fill **approximately 62,500 to 84,000 job openings (Low Growth and Expansion scenarios respectively) due to industry activity and age-related attrition.**

Net Hiring Requirements in Short- and Long-term, by Petroleum Industry Sector

Industry Sector	2012 Employment	Short-Term Net Hiring (to 2015)		Long-Term Net Hiring (to 2022)	
		Low Growth	*Expansion*	*Low Growth*	*Expansion*
Oil and gas services	94,100	17,700	21,800	37,700	47,900
Conventional E&P	72,000	4,700	6,500	6,850	10,700
Oil sands	22,300	6,900	6,900	14,900	22,200
Pipelines	6,800	840	840	3,000	3,250
Total industry	**195,200**	**30,140**	**36,040**	**62,450**	**84,050**

FIG. 10 *Numbers have been rounded.*

Short-Term Net Hiring Requirements (to 2015) for Top Ten Oil and Gas Occupations

Occupation	2012 Employment	Short-Term Net Hiring (to 2015)	
		Low Growth	*Expansion*
Total industry	**195,200**	**30,100**	**36,000**
Oil and gas well drillers, servicers, testers, and related workers	12,310	1,450	1,850
Primary production managers	6,765	1,505	1,835
Oil and gas drilling, servicing, and related labourers	12,940	1,325	1,735
Supervisors, oil and gas drilling and service	9,570	1,245	1,510
Heavy equipment operators (except crane)	7,080	1,355	1,510
Truck drivers	6,440	1,060	1,310
Petroleum engineers	6,860	1,070	1,305
Power engineers (steam-ticketed operators)	4,945	1,290	1,305
Oil and gas well drilling workers and service operators	9,030	955	1,235
Geologists and geophysicists	4,720	930	1,165

FIG. 11

Long-Term Net Hiring Requirements (to 2022) for Top Ten Oil and Gas Occupations

Occupation	2012 Employment	Long-Term Net Hiring (to 2022)	
		Low Growth	*Expansion*
Total oil and gas industry	**195,200**	**62,500**	**84,000**
Power engineers (steam-ticket required)	4,945	2,945	4,105
Heavy equipment operators (except crane)	7,080	2,425	3,990
Oil and gas well drillers, servicers, testers, and related workers	12,310	2,945	3,985
Primary production managers	6,765	3,050	3,945
Supervisors, oil and gas drilling and service	9,570	2,930	3,640
Oil and gas drilling, servicing, and related labourers	12,940	2,415	3,480
Petroleum engineers	6,860	2,150	2,910
Truck drivers	6,440	2,200	2,825
Oil and gas well drilling workers and service operators	9,030	1,860	2,590
Geologists and geophysicists	4,720	1,715	2,305

FIG. 12

Hiring Due to Workforce Competition

There is significant competition for employees between oil and gas companies, petroleum industry sectors and key industries within Canada. A three per cent non-retirement turnover significantly increases the number of job vacancies industry will need to fill, adding 62,600 and 65,800 job openings in the Low Growth and Expansion scenarios respectively.

As a result, **total hiring over the next decade ranges between 125,000 and 150,000 to address industry activity, age-related attrition and non-retirement turnover.** Some occupations, such as entry-level oil and gas services positions, experience considerably higher unemployment rates.[6] Companies need to adopt innovative recruitment strategies to remain competitive and sustain production levels.

The intense competition for talent within and outside of the industry creates significant additional job openings.

Oil and Gas Industry's Total Hiring Outlook to 2022

FIG. 13

PROJECTED LABOUR AND SKILL SHORTAGES

The oil and gas industry is already dealing with labour and skill shortages. In both scenarios, **there is no relief in sight with projected industry unemployment rates falling and staying below a balanced labour market[7] throughout the outlook period.**

Labour Supply/Demand Gaps to 2022

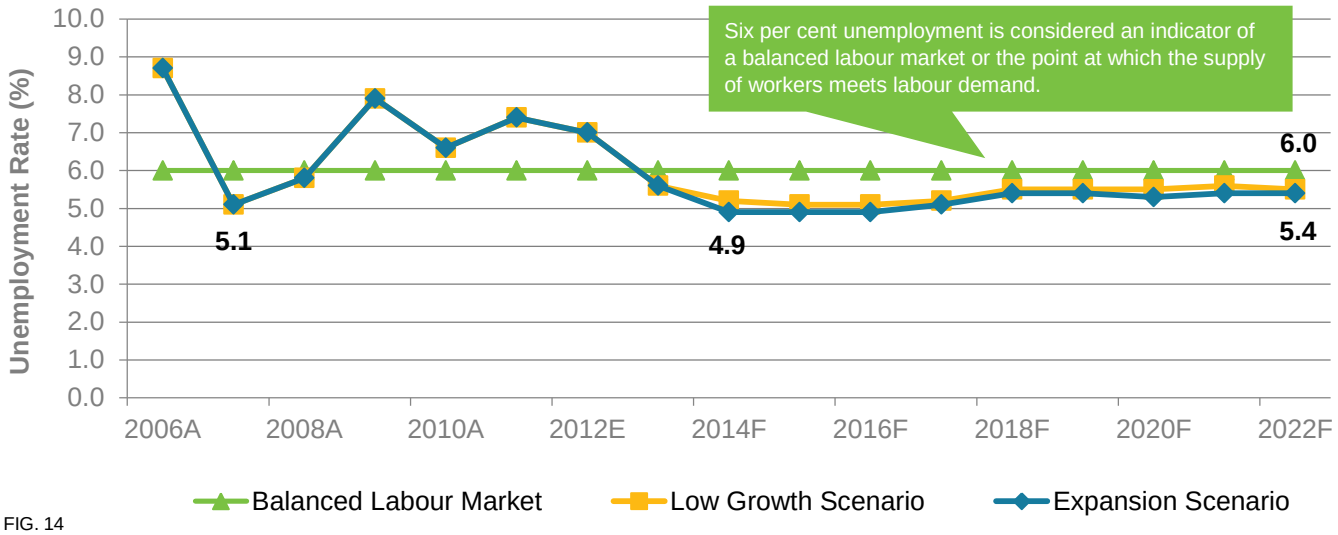

FIG. 14

Severe labour and skill shortages experienced in 2007 are expected to return by 2014 when the industry unemployment rate falls to around five per cent in either scenario.

Energy-producing provinces, particularly in Western Canada, have the lowest unemployment rates. Tighter labour markets and labour shortages exist in BC, Alberta, Saskatchewan and Manitoba. Low unemployment rates in Alberta, Saskatchewan and Manitoba indicate a current labour shortage as these provinces experience unemployment below the six per cent rate that is considered to be balanced.

Unemployment Rates in Canada (February 2013)

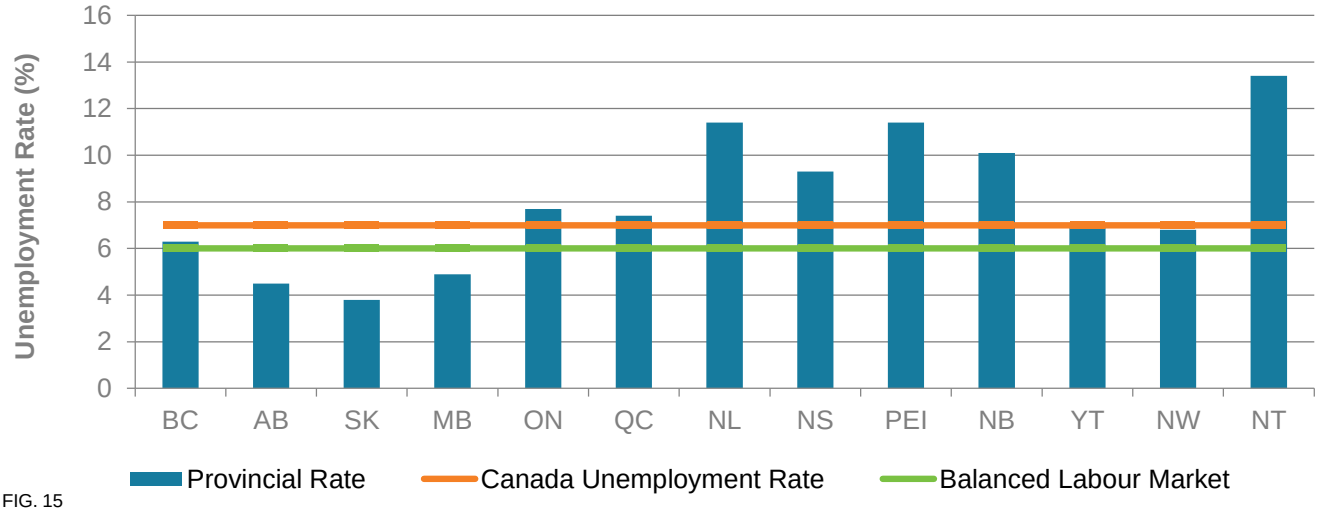

FIG. 15

From an occupational perspective, the list below includes occupations with ten-year average projected unemployment rates below the balanced rate in both scenarios, and therefore considered to expect "labour shortages."[8]

- Chemical engineering technologists
- Chemical engineers
- Civil engineers
- Crane operators
- Drafting technologists and technicians
- Drilling coordinators/production managers
- Electrical/instrumentation engineers
- Environmental technicians
- Geologists and geophysicists
- Heavy equipment operators
- Heavy-duty equipment mechanics
- Industrial electricians
- Industrial engineering and manufacturing technologists and technicians
- Inspectors in public and environmental health and safety
- Instrumentation engineering technologists
- Instrumentation technicians
- Insulators
- Mechanical engineering technologists
- Mechanical engineers
- Millwrights and machinists
- Mining engineers
- Non-destructive testers and inspection technicians
- Oil and gas drilling, servicing, and related labourers
- Oil and gas well drillers, servicers, testers, and related workers
- Oil and gas well drilling workers and service operators
- Petroleum engineers
- Petroleum/mining/geological engineering technologists
- Power engineers (steam-ticket required)
- Project engineers
- Purchasing agents and officers
- Steamfitters and pipefitters
- Supervisors, oil and gas drilling and service
- Truck drivers
- Welders

There are other occupations, such as production clerks and supervisors, petroleum, gas and chemical processing and utilities where there will be enough workers projected over the next decade (quantitative balance), however, there may be gaps in the skills and experience the industry is looking for. This is typically referred to as a "skill shortage."

Labour and skill shortages for many occupations critical to oil and gas operations are expected to challenge the industry over the next decade.

SECTOR ANALYSIS

OVERVIEW

Positive momentum and growth opportunities exist in all oil and gas sectors. At the same time, **all sectors will be challenged to manage risks associated with an aging workforce** and will need to ensure workers are available to fill jobs vacated due to age-related attrition. This section of the report provides an overview of future net hiring requirements and examines specific challenges for each industry sector.

OIL AND GAS SERVICES SECTOR

In 2012, the sector employed over 94,000 workers, a four per cent growth over 2011 employment levels. Growth in the oil and gas services sector will continue in either scenario.

In both scenarios, employment in the oil and gas services sector will increase to meet growing demands for production from oil sands and shale oil and gas. In the Expansion scenario, the development of the LNG export sector will drive additional employment growth.

Over the next decade, the oil and gas services sector is projected to add 16,400 jobs in the Low Growth and 25,900 in the Expansion scenario.

Oil and Gas Service Employment Outlook to 2022

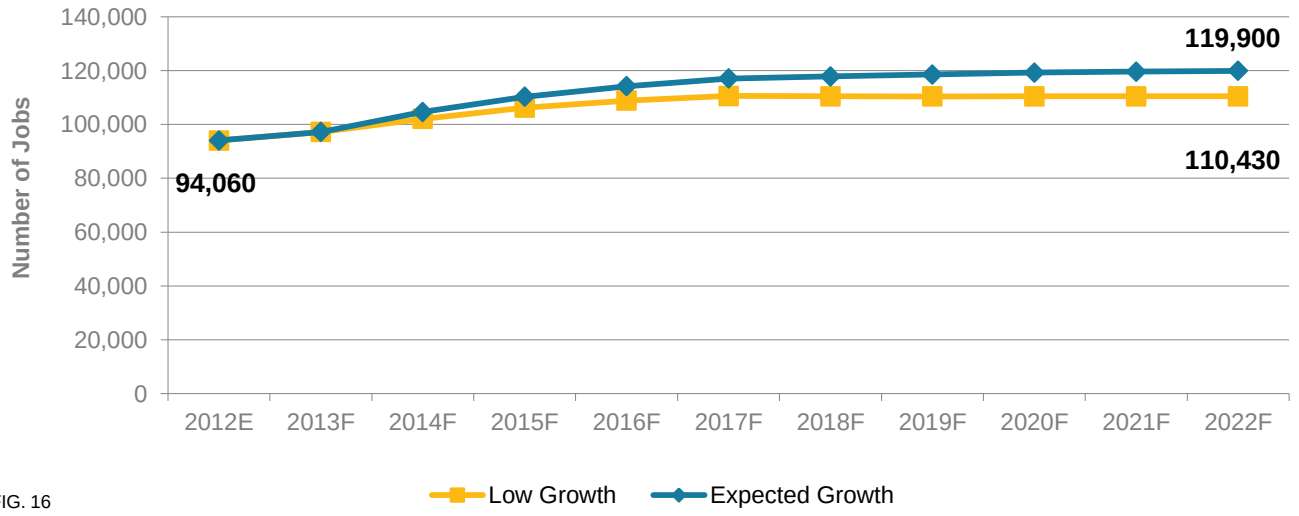

FIG. 16

Age-related attrition will increase hiring requirements for the sector by over 21,000 jobs. Over the next decade, **the oil and gas services sector will need to fill between 37,700 and 47,900 job openings (Low Growth and Expansion scenarios respectively)** due to industry activity and age-related attrition.

Net Hiring Requirements to 2022 for Top Ten Oil and Gas Services Occupations

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total oil and gas services sector	**94,060**	**37,700**	**47,900**
Oil and gas well drillers, servicers, testers, and related workers	8,960	3,025	3,990
Oil and gas drilling, servicing, and related labourers	9,080	2,630	3,605
Supervisors, oil and gas drilling and service	5,790	2,635	3,270
Truck drivers	5,280	2,105	2,675
Oil and gas well drilling workers and service operators	6,185	1,965	2,630
Drilling coordinators/production managers	4,140	1,990	2,435
Heavy equipment operators (except crane)	3,265	1,300	1,645
Millwrights and machinists	2,820	1,125	1,430
Welders	2,375	910	1,165
Geologists and geophysicists	1,710	800	980

FIG. 17

The close connection between oil and gas services and oil sands operations is increasingly apparent. The following chart illustrates that oil and gas services sector employment aligns more closely to growth in oil sands than it does to conventional E&P. This is significant for the sector as oil sands development is more stable than conventional E&P. In addition, heavy oil wells require more servicing than light oil and natural gas wells.

It is anticipated that the advancement of LNG will also contribute to improved job stability for the oil and gas service workforce due to the continuous need for feed gas to fulfill long-term export contracts (up to 20 years). Service companies that are able to secure long-term service contracts should be able to offer greater job stability, making it easier to attract and retain employees.

Oil and Gas Services, Conventional E&P and Oil Sands In Situ Employment Outlook to 2022 in Expansion Scenario

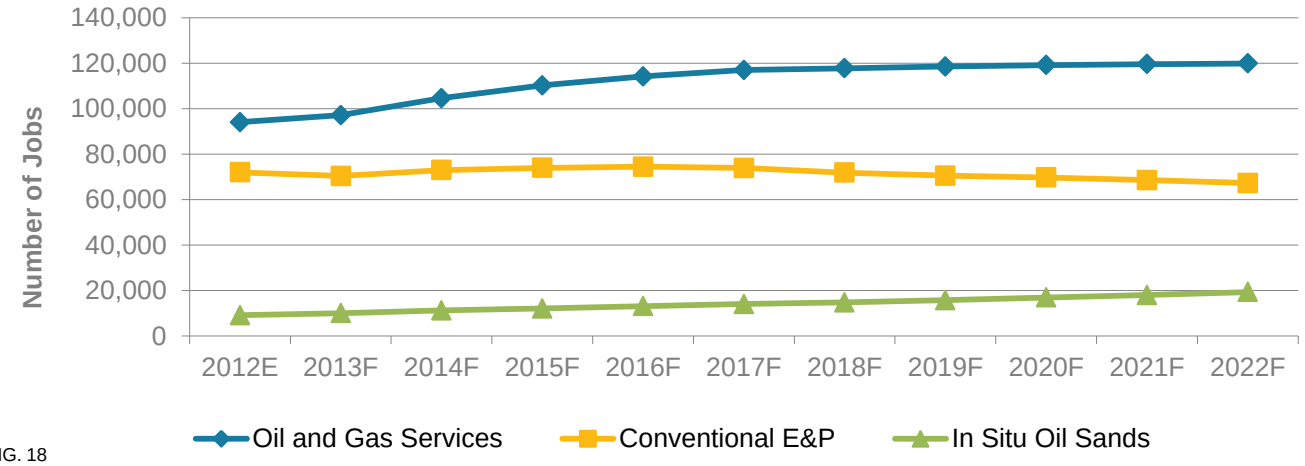

FIG. 18

Challenges: Oil and Gas Services Sector

The oil and gas services sector is already experiencing serious attraction and retention challenges. As the industry's contracted services, the oil and gas services sector's employment is most impacted by oil and gas price volatility. When E&P companies reduce their capital expenditures and therefore their requirement for contracted services, the oil and gas service companies have typically reacted to the decrease in contracts with employee layoffs. Following the last economic downturn in 2008, service sector companies were challenged to find experienced service workers during subsequent recovery in 2009 because many experienced workers found employment in other, more stable sectors.

> One of the greatest challenges for the oil and gas services sector is the competitive recruitment of its workforce by other industries and sectors.

In addition to the cyclicality associated with the oil and gas services sector, the nature of the work creates attraction and retention challenges. Workers in the services sector typically work outdoors in inclement weather, are away from home for long periods of time living in company-provided accommodation or camps and are employed seasonally.

The oil and gas services sector experiences the highest employee turnover rates in the industry. For this reason, actual hiring activity is way beyond what is created by industry activity and age-related attrition. For example, companies are reporting turnover rates exceeding 50 per cent for entry-level drilling and service occupations. The following chart illustrates the impact of this rate of employee loss on recruitment activity for this occupation.

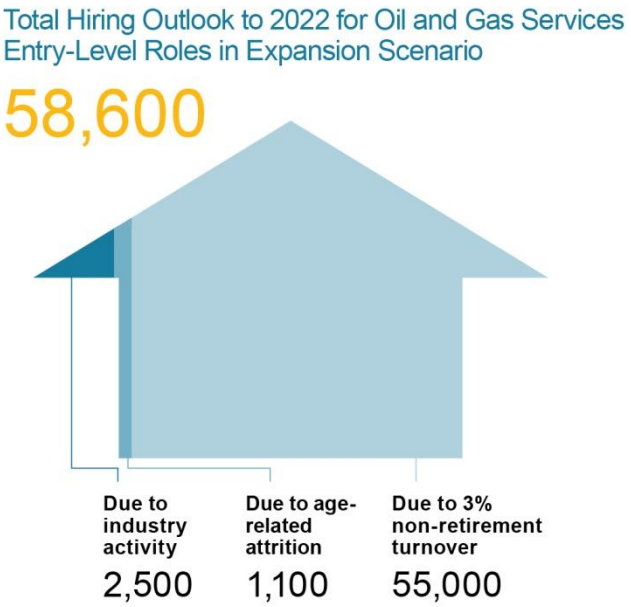

FIG. 19

Challenges surrounding succession planning also exist. As experienced workers leave the sector, knowledge transfer opportunities significantly decrease with fewer people to mentor and train younger workers.

To minimize workforce risks and successfully recruit and retain workers, strategic workforce planning and innovative attraction and retention solutions are key. Oil and gas service companies offering adjusted compensation structures and employment contracts to offer full-time, year-round work have had improved success with attraction and retention of previously untapped labour pools. This strategy has also helped companies access TFWs. In addition, companies that support travel and accommodation are able to attract workers from Eastern Canada.

Exploration and Production (E&P) Sector

Employing approximately 94,300 workers, the E&P sector consists of large, integrated companies involved in both oil sands and conventional oil and gas activity, as well as small- to mid-sized E&P companies focused on conventional activity.

There is great opportunity for the sector to grow through LNG export development, oil sands development and expanded offshore activities. In order for Canada's oil and gas industry to capture these opportunities, significant investment from the E&P sector is required. New oil sands operations, especially mining and upgrading projects, are very expensive and a significant amount of time is required to establish projects. To date, six LNG export projects have been announced, however, not all projects are likely to be developed.

In recent years, diversified and oil-based companies show more profitability than gas-based companies because they have been able to better respond to – and ride out – market price fluctuations. For workers, a diversified sector means greater employment stability. For example, recent layoffs have been made by conventional E&P companies focused on natural gas activity. As identified previously, a diversified and stable E&P sector also provides more stability to the oil and gas services sector.

E&P Employment Outlook to 2022

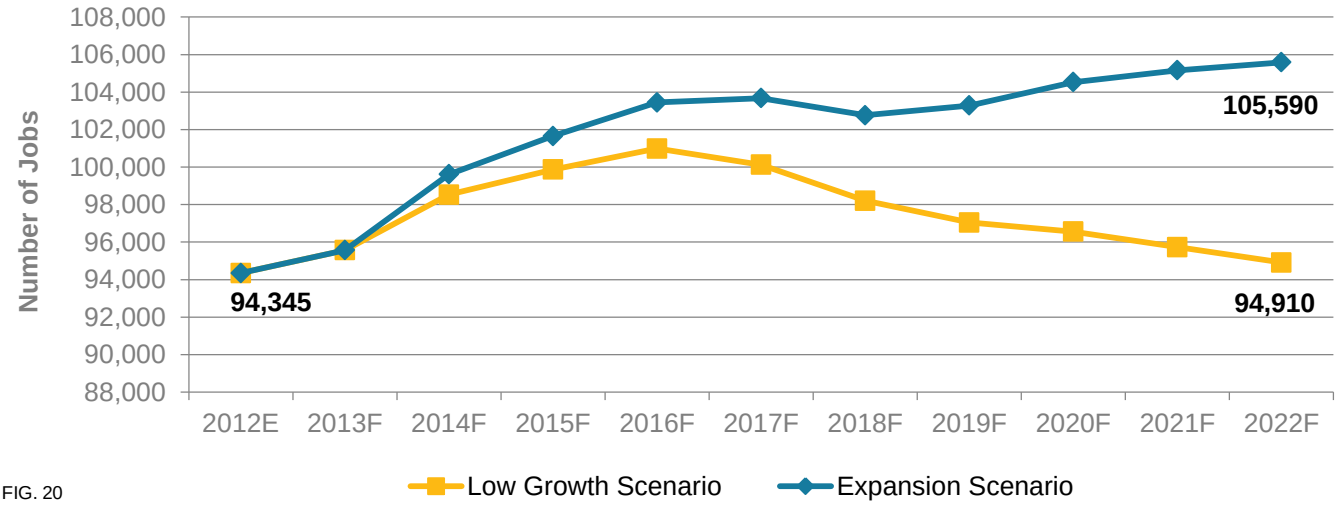

FIG. 20

The proportion of the E&P workforce involved in conventional activity lessens over time as the oil sands workforce continues to grow at a significant pace.

Conventional E&P and Oil Sands Employment Outlook to 2022

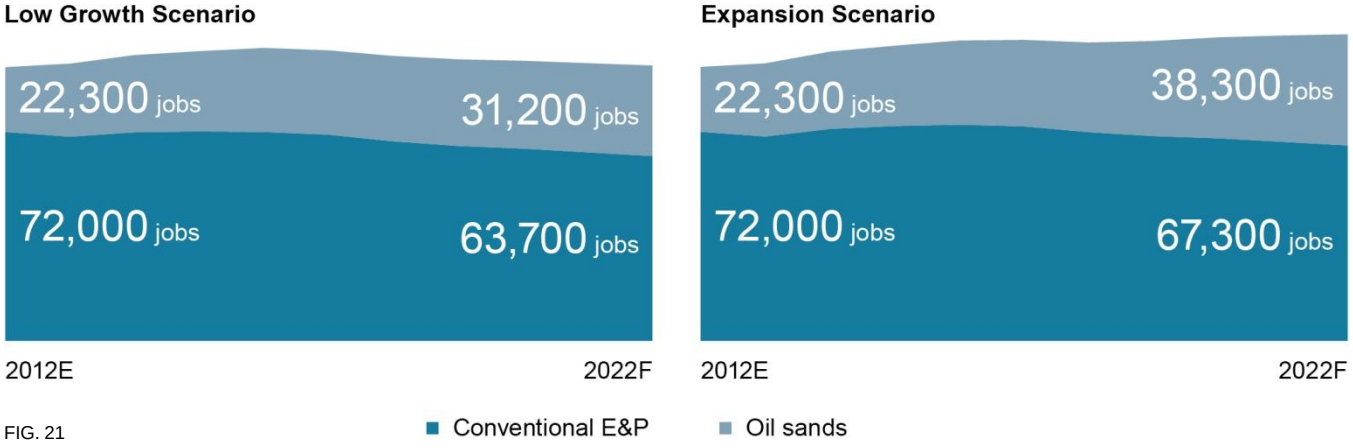

FIG. 21

Despite a decline in the total number of conventional E&P jobs, age-related attrition will still drive the need to fill vacancies created by workforce retirements. It is expected that between **6,850 and 10,700 job openings (Low Growth and Expansion scenarios respectively) will need to be filled in the conventional E&P sector during the outlook period, primarily driven by age-related attrition.**

Net Hiring For Top Ten Conventional E&P Occupations to 2022

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total conventional E&P sector	**72,000**	**6,830**	**10,700**
Petroleum engineers	4,330	595	920
Geologists and geophysicists	2,655	585	880
Drilling coordinators/production managers	2,005	535	800
Petroleum, gas, chemical process operators (no steam-ticket required)	4,600	310	465
Petroleum/mining/geological engineering technologists	1,250	215	350
Purchasing agents and officers	1,055	225	345
Supervisors, oil and gas drilling and service	3,730	270	345
Supervisors, petroleum, gas and chemical processing and utilities	975	135	155
Millwrights and machinists	1,595	75	130
Truck drivers	1,095	75	120

FIG. 22

Oil sands operations in the E&P sector will require significant hiring over the long term to 2022 with estimates of job openings reaching between 14,900 and 22,200 positions (Low Growth and Expansion scenarios respectively).

Net Hiring For Top Ten Oil Sands Occupations to 2022

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total oil sands sector	**22,340**	**14,900**	**22,185**
Power engineers (steam-ticket required)	3,815	2,870	3,985
Heavy equipment operators (except crane)	3,055	1,080	2,270
Petroleum engineers	810	810	1,070
Heavy-duty equipment mechanics	985	430	775
Drilling coordinators/production managers	570	500	685
Instrumentation technicians	560	400	570
Mechanical engineers	575	370	545
Industrial electricians	565	310	495
Millwrights and machinists	565	310	490
Geologists and geophysicists	355	330	445

FIG. 23

Challenges: E&P Sector

The conventional E&P sector demands many unique and specialized occupations, especially in the engineering, engineering technology and geosciences job families. As a result, there are fewer labour supply sources for these skilled workers, and experienced technical employees are increasingly targeted by headhunters. Adding to this challenging situation over the next decade is the increasing risk for significant experience gaps resulting from age-related attrition.

> The uniqueness of some E&P occupations limits labour supply opportunities and increases recruitment and retention challenges.

There is significant transferability of worker skill sets between conventional E&P and in situ operations, the fastest growing type of oil sands activity. This is positive for integrated companies as they can move employees between conventional and in situ operations. Companies focused solely on conventional E&P activity may experience greater competition for skilled workers due to increased oil sands activity.

An additional workforce planning challenge is the sector's long-time practice of staffing for the bottom of market cycles and relying more heavily on the contracted oil and gas services sector to staff up for the peaks. This practice has left the E&P sector vulnerable to the oil and gas services sector's ability to attract and retain workers, which has become exceedingly difficult in recent years.

Looming retirements of contracted, senior service sector supervisors is also seen as a potential risk. To be proactive in dealing with this risk, some conventional E&P companies are hiring internally rather than contracting for these positions.

Between hiring for expansion, age-related attrition and non-retirement turnover, the oil sands sector[9] could find themselves recruiting for vacancies equivalent to 140 per cent of its current workforce. Of specific concern are the recruitment challenges associated with in situ activities. The technology is relatively new and therefore unique to the Canadian oil sands sector, resulting in a limited pool of qualified candidates.

The sector already copes with extensive employee movement among oil sands companies, especially during start-up and commissioning phases when companies seek to attract experienced workers. This challenge will be compounded further as additional companies strive to meet market demands and prepare for the commissioning phase of new facilities.

> Over the next decade oil sands companies will need to recruit for job vacancies equivalent to over 140 per cent of 2012 employment levels.

Pipeline Sector

If Canada's oil and gas industry is to move toward **successful market diversification**, **a critical necessity will be increasing pipeline capacity and building new pipelines to supply international markets**. Engaging stakeholders and strengthening relationships with Aboriginal communities is key to the sustainable growth of this sector.

> The pipeline sector is facing considerable public scrutiny and as a result is challenged to gain the social license to expand and operate.

There are several thousand kilometers of new pipelines required to realize market diversification. The construction phase of the pipeline expansion will be significant and the labour requirements will be intense. In comparison, pipeline operations require fewer employees than the construction phase. Projected employment growth for pipeline operations does not differ significantly between scenarios, however, the growth is significant given the current size of the workforce. **The pipeline sector will add between 1,350 and 1,600 jobs (Low Growth and Expansion scenarios respectively) to 2022.**

> Pipeline operations employment is expected to increase by 20 to 25 per cent of its 2012 employment level — a very significant increase given its current workforce size.

Pipeline Employment Outlook to 2022

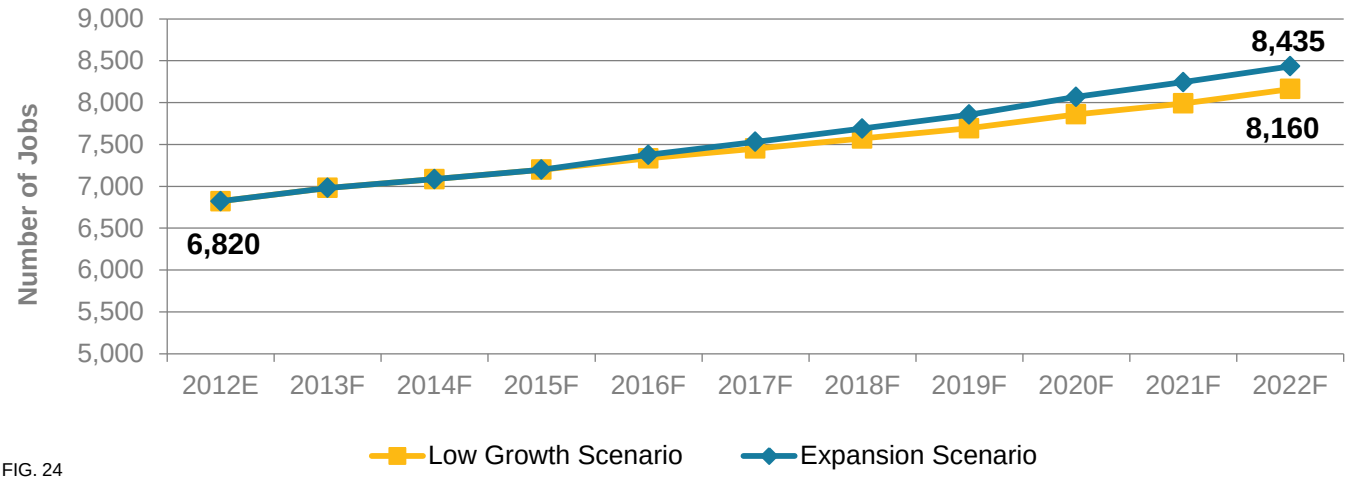

FIG. 24

In addition to employment growth to support pipeline operations, the sector will need to fill approximately 1,650 vacancies due to age-related attrition. The **net hiring due to employment growth and retirements is between 3,000 and 3,250 job openings (Low Growth and Expansion scenarios respectively)** or between 44 and 48 per cent of 2012 pipeline employment levels.

Net Hiring For Top Ten Pipeline Occupations to 2022

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total pipelines sector	**6,820**	**3,005**	**3,270**
Petroleum, gas, chemical process operators (includes pipeline operators)	690	305	330
Petroleum engineers	205	90	95
Millwrights and machinists	180	75	80
Production clerks	130	60	65
Industrial electricians	130	55	60
Chemical engineers	130	50	55
Instrumentation technicians	115	45	50
Mechanical engineers	115	45	50
Purchasing agents and officers	65	30	35
Instrumentation engineering technologists	65	25	30

FIG. 25

Challenges: Pipeline Sector

Pipeline operations are dispersed across Canada and often located in small, rural communities. This can create attraction and retention challenges if a local labour pool is not available and workers are required to relocate.

In addition, the pipeline sector is planning expansions in regions already experiencing significant skill shortages. **Pipeline companies will face competition from expanding oil sands projects, as companies continue to recruit skilled workers** to locations such as Fort McMurray, Alberta. Competition also exists from other industries in Saskatchewan and BC that are recruiting workers with transferable skills.

PROVINCIAL ANALYSIS

The economic benefits of the Canadian oil and gas industry are undeniable. While direct industry employment is concentrated in the energy-producing regions, the indirect benefits associated with oil and gas investment are widespread across Canada.

This section of the report summarizes the impact of direct employment for each of the scenarios for the three Western provinces and the rest of Canada. It also identifies the indirect employment generated in each province as a result of oil and gas investment in Canada.[10] Indirect employment is the additional jobs created within other industries that are selling products and/or services to the oil and gas industry.

BRITISH COLUMBIA

The majority of BC's industry operates in the northeastern part of the province and is focused on natural gas exploration, production, processing and transportation.

Gateway to Asian Markets

The **development of the oil and gas export sector will expand BC's industry beyond the northeastern region of the province**. Oil pipelines and rail deliveries to BC ports and LNG export facilities are planned for the northwestern coast, including Kitimat and Prince Rupert. While six LNG export facilities and associated pipelines have been announced to date, it is highly unlikely that all six will proceed. Final investment decisions for LNG export projects are expected to be made over the next two years. To move ahead, there will need to be long-term customer contracts in place and a supply of low cost feed gas from BC and possibly Alberta.

Companies involved in exploring the feasibility of LNG exports from BC are opening offices and placing staff in Vancouver, Prince George, Prince Rupert and Kitimat, resulting in new employment opportunities. These are head office type jobs that are involved in the early stage planning of projects including regulatory, stakeholder relations and business development roles.

> Increased industry activity in BC is dependent on an increased price for natural gas through growth in North American demand and/or market diversification.

Foreign investment and the province's liquids-rich natural gas plays have kept BC's industry busier than expected, given the lingering low natural gas price environment. However, the province is at a turning point as BC, and the rest of Canada, wait to see if the development of an LNG export sector proceeds. As a result, BC's industry and activity levels are expected to remain stable through 2013 and employment is not expected to change from current levels of just over 12,000 workers in the near term.

In the Low Growth scenario, where increased demand is from domestic sources, employment only grows by 640 jobs to 2022. In the Expansion scenario, where the development of a BC-based LNG export[11] industry increases demand beyond the increased domestic use of natural gas, the projected employment growth is 1,600 jobs to 2022.

BC Oil and Gas Industry Employment Outlook to 2022

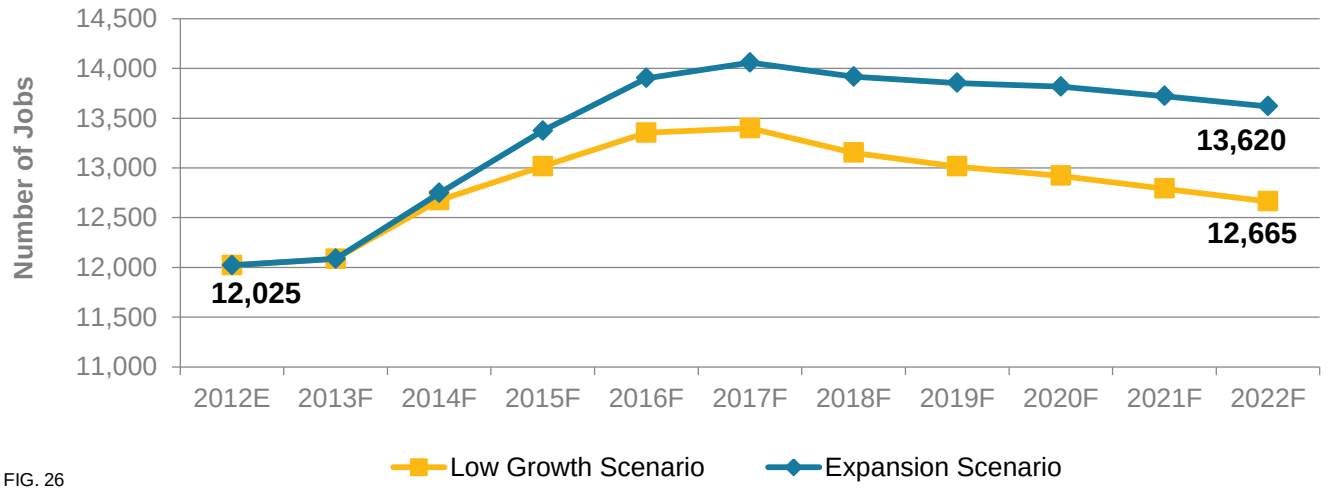

FIG. 26

Age-related attrition will create another 2,450 job openings within the BC-based workforce. Projected **net hiring for BC's oil and gas industry is estimated to be between 3,100 and 4,100 positions (Low Growth and Expansion scenarios respectively).**

Occupations expected to be in greatest demand in BC due to industry activity and age-related attrition are those involved in the drilling and development of wells required to produce natural gas. There is also an increased need for process operators involved in gas processing operations that will be required in LNG facilities.

Net Hiring Requirements to 2022 for Top Ten BC-based Oil and Gas Occupations

Occupation	2012 Employment	Net Hiring Requirements To 2022	
		Low Growth	*Expansion*
Total BC-based oil and gas industry	**12,020**	**3,090**	**4,110**
Oil and gas well drillers, servicers, testers, and related workers	1,390	285	410
Oil and gas drilling, servicing, and related labourers	1,465	225	355
Supervisors, oil and gas drilling and service	940	245	315
Truck drivers	750	225	300
Oil and gas well drilling workers and service operators	1,020	180	265
Drilling coordinators/production managers	430	180	230
Petroleum, gas, chemical process operators (no steam-ticket required)	795	145	185
Heavy equipment operators (except crane)	465	135	180
Millwrights and machinists	535	130	175
Welders	360	95	130

FIG. 27

Indirect Employment Impacts

Investment in Canada's oil and gas industry is expected to support between **54,000 and 75,600 indirect jobs (Low Growth and Expansion scenarios respectively)** each year to 2022 in BC. For every direct worker employed in BC's oil and gas industry, another three to five workers are employed indirectly. The industries that will most benefit from oil and gas expenditures include:

- construction, including oil and gas engineering
- professional, scientific and technical
- accommodation and food services
- waste management and remediation services
- finance, insurance, real estate and rental and leasing
- manufacturing
- transportation and warehousing

Key Workforce Considerations

BC's oil and gas industry currently struggles to attract and retain enough workers. The labour market in Northeast BC, where all of the gas activity currently occurs, consistently has the province's lowest unemployment rate and is already operating at capacity. One of BC's greatest challenges in balancing its labour market is that the vast majority of labour force resides in the southern region of the province, while industrial growth is taking place in the north. Traditional migration of BC residents has been from north to south and this will need to be reversed to fill growing employment in the north.

In addition to drilling, producing and processing natural gas for LNG, **there is a significant need for infrastructure to support the development of a LNG export sector.** Northern BC has a very small labour force (three per cent of provincial total) and will need to attract a substantial number of workers to fulfill construction and operations requirements.

SPOTLIGHT: LNG DEVELOPMENT IN BC

Given its early stage of development, the potential for LNG exports off the coast of BC is evolving. As of February 2013, six projects had been announced.

The Petroleum HR Council (now part of Enform) was contracted by the BC Natural Gas Workforce Strategy Committee to develop labour demand projections for the construction and operations associated with natural gas development in British Columbia. Two scenarios were explored: one with three LNG plants and associated pipelines and a second with five LNG plants and associated pipelines to be constructed and operational by 2020.

Based on publicly announced data by LNG project proponents on construction timelines, plant size and capacity and pipeline length, the potential employment impact of three to five LNG plants in BC are:

- 11,790 – 22,610 direct, on-site construction jobs created (peak is 2017)
- 6,800 – 22,600 new direct jobs within the oil and gas services, conventional E&P and pipeline sectors.

ALBERTA

Alberta's oil and gas industry directly employed close to 160,000 workers in 2012. In addition to the oil and gas field and operations employment across the province, Alberta is also home to the majority of the industry's head office jobs.

Alberta's direct oil and gas employment will grow steadily in both scenarios due to the stability of the oil sands sector and investment in conventional oil and liquids-rich natural gas.

Technology is having a significant impact on the province's oil and gas production potential. A decade ago, the belief was that the province had no new conventional oil and gas plays to explore and that by 2012 Alberta's industry would be focused on harvesting from a mature basin.[12] **Today, everything old within Alberta's conventional industry is new again, as technology is allowing companies to undertake new exploration and rework old wells.** For Alberta, an additional upside is that the industry creates its own demand for natural gas and condensate with the development of oil sands. However, the industry's ability to realize the full benefits of technological advancements is still hindered by pipeline capacity and a single customer (US).

In the Low Growth scenario with continued market limitation, the province adds 17,100 jobs over the next decade. In the Expansion scenario, the province adds double the number of jobs at 35,000.

Alberta Oil and Gas Industry Employment Outlook to 2022

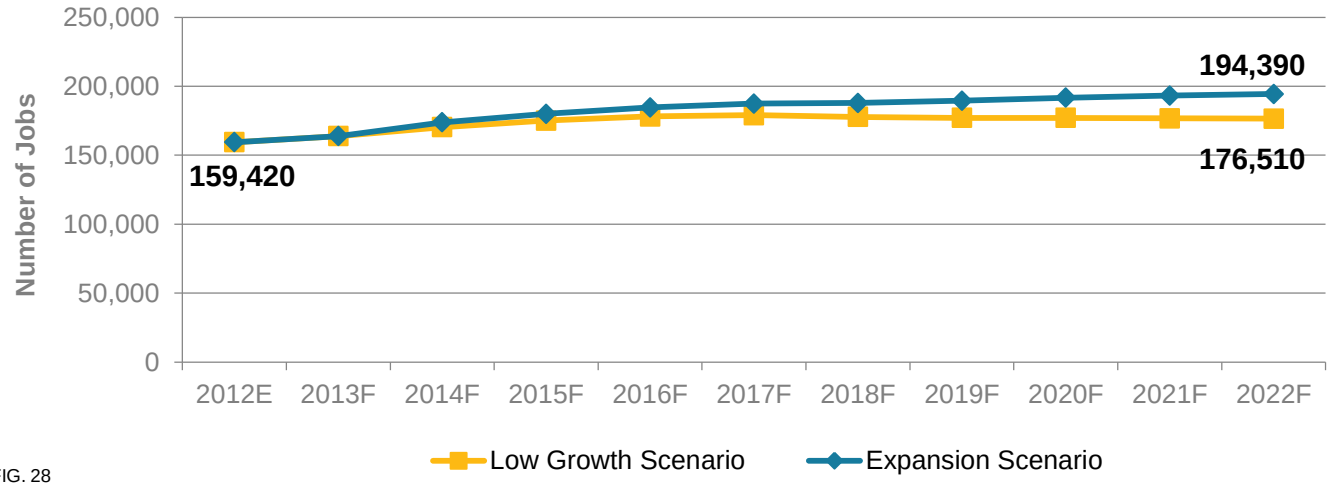

FIG. 28

Workforce retirements and its impact on hiring requirements will be a key consideration for companies operating in Alberta, as age-related attrition creates approximately 37,000 additional job openings. This brings **net hiring requirements to 53,800 to 72,700 (Low Growth and Expansion scenarios respectively) to 2022**.

Oil sands development generates significant demand for two key occupations: power engineers and heavy equipment operators. Many of the others in the top ten occupations with high demand are unique to the industry.

Net Hiring Requirements to 2022 for Top Ten Alberta-based Oil and Gas Occupations

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total Alberta-based oil and gas industry	**159,420**	**53,805**	**72,700**
Power engineers (steam-ticket operators)	4,595	2,925	4,075
Heavy equipment operators (except crane)	5,930	2,110	3,575
Drilling coordinators/production managers	5,570	2,585	3,350
Oil and gas well drillers, servicers, testers, and related workers	8,800	2,305	3,065
Supervisors, oil and gas drilling and service	7,050	2,320	2,865
Oil and gas drilling, servicing, and related labourers	9,225	1,920	2,700
Petroleum engineers	6,025	1,920	2,605
Truck drivers	4,600	1,690	2,140
Geologists and geophysicists	4,125	1,510	2,040
Oil and gas well drilling workers and service operators	6,440	1,465	2,000

FIG. 29

Indirect Employment Impacts

About 65 per cent of the indirect employment generated by oil and gas investment in Canada is based in Alberta. The indirect oil and gas employment in Alberta ranges from **262,500 to 318,100 jobs (Low Growth and Expansion scenarios respectively) per year.**

Given the heavy capital investment associated with **oil sands development** in the province, it is not surprising that the **greatest number of indirect jobs is generated within the construction industry.** Indirect employment is also created within the following industries:

- professional, scientific and technical
- finance, insurance, real estate and rental and leasing
- accommodation and food services
- manufacturing
- waste management and remedial support
- transportation and warehousing

Key Workforce Considerations

The volume of hiring required by Alberta's oil and gas industry will create challenges for companies, especially since the **provincial labour market is currently employed at full capacity.** There is significant risk around increased employee turnover rates given the number of hires required for industry-specific occupations and the limited labour supply available. Employee turnover tends to drive up compensation and can put additional strain on the economics of projects.

Growth in oil sands will also present challenges. Given the limited oil sands operations in the world,[13] Alberta has few experienced labour pools to draw on and companies will need to focus on building a workforce with the required skills and qualifications. Recent provincial cuts to post-secondary training will create challenges around developing Alberta's labour market to address industry workforce and skill requirements. Increasing participation of under-represented groups such as Aboriginal peoples and new Canadians are key solutions. Attracting and retaining workers from outside the province and country will also be required to address industry employment growth within the province.

SASKATCHEWAN

Growth of Saskatchewan's oil and gas industry is driven by **increased activity in the prolific Bakken shale oil formation**, found in the southeastern part of the province. As with shale gas, technology is reversing the decline in the production of light oil. Technology is also impacting industry activity around Lloydminster as the industry is applying thermal technology to enhance production from heavy oil deposits in the area.

> Technology is driving growth in Saskatchewan's heavy and light oil activity.

Increasing oil production in Saskatchewan is adding to **pipeline capacity concerns**. As a result, rail terminals are expanding their capacity to ship oil. Communities such as Estevan, Weyburn and Carlyle are fast growing hubs for industry activity with new field offices, rail terminals and increased workforce needs.

In 2012, Saskatchewan employed over 11,600 oil and gas workers. With the increased use of rail to address pipeline capacity issues, the province's activity is expected to increase over the next couple of years, regardless of scenario. However, employment growth in the Low Growth scenario will be limited to approximately 300 jobs if pipeline capacity issues are not addressed. In the Expansion scenario, the province may add close to 1,100 jobs.

Saskatchewan Oil and Gas Industry Employment Outlook to 2022

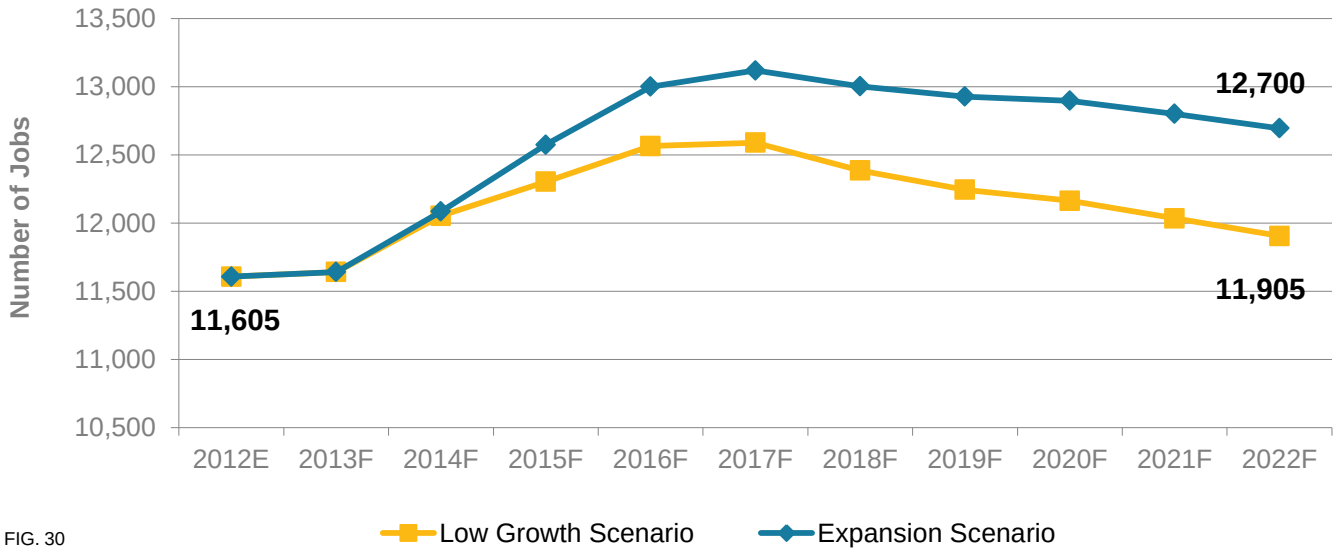

FIG. 30

Age-related attrition increases hiring by approximately 2,300 jobs. In total, Saskatchewan's oil and gas industry will **need to fill between 2,600 and 3,450 job openings over the next decade (Low Growth and Expansion scenarios respectively).**

Net Hiring Requirements to 2022 for Top Ten Saskatchewan-based Oil and Gas Occupations

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total Saskatchewan-based oil and gas industry	**11,605**	**2,615**	**3,450**
Oil and gas well drillers, servicers, testers, and related workers	1,365	230	330
Oil and gas drilling, servicing, and related labourers	1,440	170	275
Supervisors, oil and gas drilling and service	965	220	275
Truck drivers	700	190	250
Oil and gas well drilling workers and service operators	1,010	140	210
Drilling coordinators/production managers	385	155	190
Petroleum, gas, chemical process operators (no steam-ticket required)	835	135	170
Heavy equipment operators (except crane)	435	115	150
Millwrights and machinists	520	110	150
Welders	340	80	105

FIG. 31

Indirect Employment Impacts

Spending by Canada's oil and gas industry generates between **17,500 and 20,500 jobs (Low and Expansion scenarios respectively)** per year in Saskatchewan. The most sizeable indirect employment impacts are in:

- construction
- manufacturing
- professional, scientific and technical services
- finance, insurance, real estate and rental and leasing
- accommodation and food services

Key Workforce Considerations

Occupations with the greatest demand in Saskatchewan are those that are associated with the oil and gas services sector. Workforce challenges include:

- high turnover rates amongst entry-level positions, and
- loss of skills and experience due to retirement from senior, experienced service and drilling occupations.

For a number of years, Saskatchewan has recorded Canada's lowest annual unemployment rates. Currently it is under five per cent, an indication that the province's labour market is fully employed. The skills and labour shortage currently experienced by the oil and gas industry is expected to worsen with increased activity and competition for workers from the mining and construction industries.

Saskatchewan's oil and gas industry will need to continue to focus on increasing labour force participation by:

- increasing participation of under-represented groups such as Aboriginal Peoples
- developing the labour force so that skills and qualifications match those required by industry
- attracting and retaining workers from outside of the province

REST OF CANADA

Currently, the majority of oil and gas activity in the rest of Canada takes place in;

- Manitoba's oil production from the Bakken shale oil formation
- Nova Scotia's offshore natural gas
- Newfoundland and Labrador offshore oil

Installation of Nova Scotia's second offshore natural gas production field centre, Deep Panuke, is currently underway. Production is expected to start later this year.

Hebron, which is Newfoundland and Labrador's fourth offshore project, is targeting first oil in 2017. This will result in the addition of approximately 700 direct jobs and many indirect jobs including approximately 3,500 construction workers. This will help to offset potential production and employment decreases from the other offshore projects in the province.

Technology has increased the potential of industry expansion across Canada, including the development of shale oil and gas deposits in Quebec, Nova Scotia (onshore), New Brunswick and Newfoundland (onshore). There is potential for LNG exports from Canada's east coast as well.

Producers and pipeline companies are looking into the feasibility of shipping oil to refineries in Eastern Canada. While considered part of downstream industry, oil from Western Canada would increase the profitability of refineries that currently rely on more expensive imported oil and would sustain, if not increase, employment.

With the reversal and/or reconfiguration of pipelines, Canada's east coast could also become the gateway for oil exports to European, Indian and Asian markets.

In the Low Growth scenario, the rest of Canada adds 250 jobs and in the Expansion scenario an additional 1,050 jobs.

Employment Outlook to 2022 for Oil and Gas Industry in the Rest of Canada

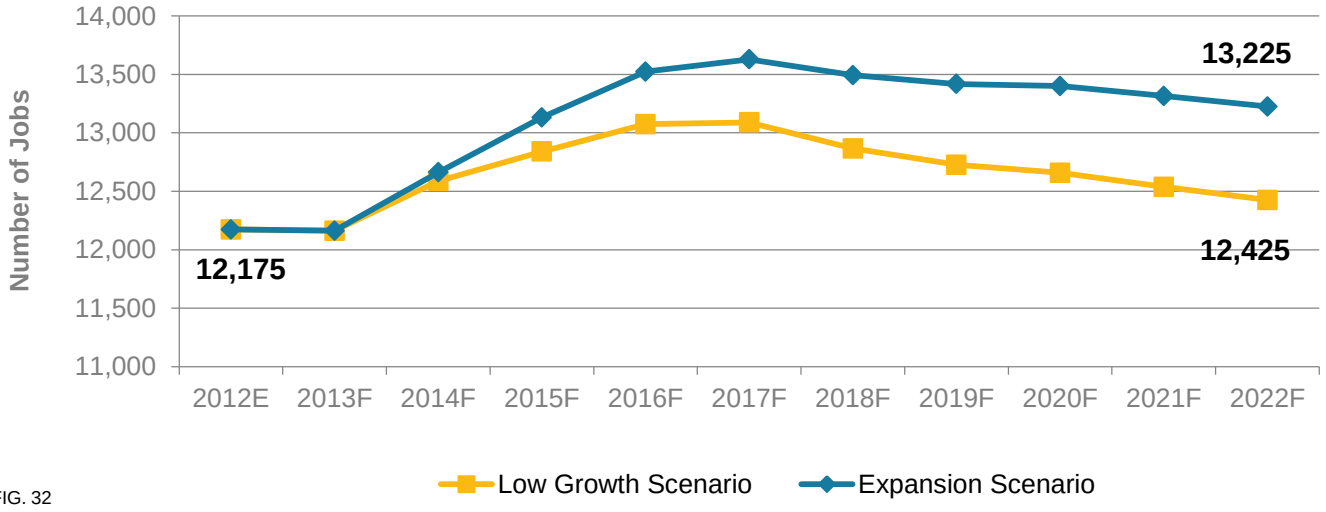

FIG. 32

When combined with the need to replace approximately 2,700 workers due to age-related attrition, the industry will **need to hire between 2,900 and 3,750 workers (Low Growth and Expansion scenarios respectively) for the rest of Canada to 2022.**

Net Hiring Requirements to 2022 for Top Ten Oil and Gas Occupations in Rest of Canada

Occupation	2012 Employment	Net Hiring Requirements to 2022	
		Low Growth	*Expansion*
Total oil and gas industry in rest of Canada	**12,175**	**2,925**	**3,770**
Supervisors, oil and gas drilling and service	610	145	185
Oil and gas well drillers, servicers, testers, and related workers	750	125	175
Drilling coordinators/production managers	380	135	175
Petroleum, gas, chemical process operators (no steam-ticket required)	595	130	155
Oil and gas drilling, servicing, and related labourers	810	95	150
Truck drivers	390	105	140
Petroleum engineers	440	95	125
Oil and gas well drilling workers and service operators	560	75	115
Geologists and geophysicists	275	75	105
Millwrights and machinists	320	75	95

FIG. 33

Indirect Employment Impacts

Oil and gas investment sustains jobs across Canada. As a result of industry's capital and operations spending, the following breaks down the indirect employment impacts in key provinces within the rest of Canada (Low Growth and Expansion scenarios respectively):

- Manitoba will average between 4,200 and 4,800 indirect jobs per year in:
  - manufacturing
  - transportation and warehousing
  - professional, scientific and technical services
- Ontario will average between 50,700 and 58,100 indirect jobs per year in:
  - manufacturing
  - professional, scientific and technical services
  - financial, insurance, real estate and rental and leasing
  - transportation and warehousing
- Quebec will average between 13,800 and 15,900 indirect jobs per year in:
  - manufacturing
  - professional, scientific and technical services
  - financial, insurance, real estate and rental and leasing
- Atlantic Canada will average between 5,500 and 5,600 indirect jobs in:
  - construction
  - professional, scientific and technical services
  - manufacturing

Key Workforce Considerations

As a developing industry across the rest of Canada, oil and gas will compete for workers with traditional industries such as construction, mining, forestry and utilities. **To be successful, youth and the labour force in general will need to be educated about oil and gas and its career opportunities, as well as have access to training that aligns with skill and occupational demands.** The offshore industry typically requires experienced workers and often looks to attract them from the industry in Western Canada.

Demand-Driven Workforce Solutions Required

To meet and address the workforce shortage, there must be collaboration between industry, government and education/post-secondary institutions. Innovative recruitment initiatives and strategic workforce planning will help all sectors to plan for either the Low Growth or Expansion scenarios.

Provinces with higher unemployment rates may offer labour supply opportunities through a variety of labour pools such as unemployed and under-employed workers, youth, new grads and new Canadians who may not be able to find employment in their home provinces, and workers from other industries with transferable skills.

To have full access to workers throughout the country, there is a need for **enhanced mobility and transferability of skills and qualifications across industries and Canada.** Companies can offer rotational schedules and accommodation and transportation supports that are attractive to workers from across Canada.

Critical to ensuring a sustainable industry workforce is the development of a more effective and efficient education and training system. Workforce numbers will increase if the education system, industry and government can work together to achieve the following:

- increase high school completion rates so that youth have the pre-requisites required for further training and to obtain long-term careers.
- increase youth enrolment in relevant post-secondary training. Currently the majority of post-secondary seats are filled by mature students, many with previous post-secondary training that is not aligned to industry needs.
- undertake effective program planning and alignment of post-secondary training with industry needs. Since the 1980's, post-secondary institutions have graduated students at rates much lower than industry requires. With looming age-related attrition, the feed system needs to ensure it is graduating enough students to address occupational demand.

Increasing energy literacy and career awareness across Canada is also required. The oil and gas industry still has to overcome a number of misconceptions and negative perceptions. There is a need to educate Canadians, not only about the direct and indirect employment opportunities and how to access them, but also about how the industry works and what it is doing to improve its environmental performance.

Another practical solution is to **increase use of apprenticeship programs,** with employers taking on more apprentices. For many, these apprentices become fulltime employees who over time gain considerable knowledge and experience.

While "Canadians first" should be top priority, temporary foreign workers (TFW) are a solution for filling temporary or shorter-term work assignments. In addition, economic immigration programs can be utilized to address labour and skill shortages within industry-specific occupations. Industry and government need to continue working together to ensure that the TFW and economic immigration programs are meeting the needs of the oil and gas industry.

Given the global competitiveness for skilled workers, there is a real need to implement demand-driven solutions to increase the pool of qualified oil and gas talent in Canada.

SPOTLIGHT: 2013 FEDERAL BUDGET ADDRESSES SKILLS SHORTAGES

Federal Human Resources Minister Diane Finley recently called the labour and skills shortage "the most significant socio-economic challenge ahead of us in Canada" (Source: Canada 2020 Conference on Skilled Trades in the Energy Sector). Solutions to address the chronic and growing skilled labour shortage are needed.

This need was reflected in the 2013 Federal Budget which incorporated several measures to develop the Canadian workforce in priority areas. These measures included:

- A Canada Job Grant program, which provides up to $15,000 per person (federal, provincial/territorial, employer funding) for skills and apprenticeship training for in-demand jobs.
- Encouraging students to seek education in high-demand fields, including skilled trades, science, technology, engineering and mathematics.
- Providing grants to First Nation youth for skills and training required to participate in large projects near their communities.

These policy measures encourage training and skills development for Canadian workers, and will support continued growth of the oil and gas sector.

The budget also provided additional funding for public infrastructure development. This may indirectly benefit the industry by enabling development of infrastructure support of oil and gas projects.

CONCLUSION

A sustainable oil and gas industry is in the best interest of Canada as whole. The benefits to direct and indirect employment, as well as to the economy are significant. Collaboration, ongoing dialogue and a commitment to innovation and outside-the-box thinking are essential to ensure that current and future workforce needs can be met.

At a time when Canada's oil and gas industry needs to become more global, it is looking internally for solutions to its greatest challenges: market diversification and skill shortages.

From a business perspective, Canada needs to transport its landlocked oil and natural gas resources to its coasts and out to global markets. Leveraging existing transportation modes, repurposing existing options and utilizing existing refineries will help to streamline and maximize production.

Without market diversification, the impact is 20,400 fewer jobs created by the oil and gas industry. Unfortunately, the drawbacks continue as with every job created within Canada's oil and gas industry, three jobs are created outside of the industry. Close to 92,000 jobs each year are also at risk across Canada in industries, such as construction, manufacturing, transportation and warehousing, utilities, financial and insurance services, and waste management and remediation if market diversification is not realized. The ripple effect is significant and far-reaching.

From a workforce perspective, the industry must work even closer together and collaborate more effectively with governments, education and training institutions and employment organizations to increase the pool of Canadian workers qualified to work in oil and gas. Canada will struggle to achieve the full benefits of market diversification for the oil and gas industry if it cannot address the growing skill shortage. Solutions must come from within the country first and cannot be fully resolved through foreign workers. To remain a global leader, it is also imperative for Canada to develop innovative workforce planning and recruitment strategies.

Canada's petroleum industry is poised for growth, but to achieve its potential a number of risks must be addressed to help alleviate uncertainty. Resolving current workforce shortages, as well as preparing for the future, is critical to the industry's longer term sustainability and success.

APPENDIX 1: OVERVIEW OF METHODOLOGY

The Petroleum HR Council's labour market projections are produced using a modelling system developed in consultation with industry and expertise of labour market forecasting economists. The modelling system shows the relationship between industry activity and employment requirements, and identifies the potential labour supply available to the industry.

The modelling system produces projections for:

- **Hiring due to industry activity:** also referred to as "expansion demand," this is the projected change in the number of workers required to realize industry activity determined by capital and operating spending and oil sands production forecasts.
- **Hiring due to age-related attrition:** also referred to as "replacement demand," this is the number of industry positions that will be vacated due to retirements and natural deaths among industry's workforce.
- **Hiring due to 3% non-retirement turnover:** number of positions vacated if 3% of the industry changes companies/positions within the year causing recruiting to backfill role.
- **Net hiring requirements:** hiring due to industry activity + age-related attrition.
- **Total hiring outlook or total recruitment activity:** hiring due to industry activity + age-related attrition + 3% non-retirement turnover.
- **Potential labour supply:** magnitude and potential sources of labour supply based on availability of workers within the Canadian labour force.
- **Labour supply-demand gaps:** quantitative comparison of industry's labour demand based on its hiring needs and share of potential labour supply by core occupation.

Determining Occupational Scope

The list of occupations detailed in the model was developed in consultation with industry. Industry identified 38 core occupations that were key and unique to the industry, had significant employment within the industry and/or were difficult to recruit for.

Core occupations were then mapped to the National Occupational Classifications (NOCs) 2006.[14] An "other occupations" category is used to capture any residual occupations and ensure total petroleum industry workforce is accounted for.

Hiring Due to Industry Activity

The model projects an occupation's growth using industry employment drivers that vary by sector:

- **Oil and Gas Services:** E&P capital and operations expenditures and oil sands capital expenditures.
- **Exploration and production:** E&P capital and operations expenditures.
- **Oil sands:** oil sands production
- **Pipelines:** oil and gas operations expenditures

Determining Current Workforce by Sector

- **Oil and Gas Services and E&P:** 2012 employment numbers for these sectors were estimated by the model using actual employment driver data gathered by StatsCan and reported by CAPP.
- **Pipelines:** 2012 employment is determined using StatsCan labour force survey data.
- **Oil Sands:** In 2011, the Petroleum HR Council enhanced oil sands labour market information by conducting a headcount/workforce survey as of December 31, 2010. Respondents represented 100% of mining; 100% of upgrading; and 73% of in situ production. Companies were asked to report their headcount by occupation, operation-type and location of work and to include only those positions that are 100% dedicated to oil sands operations. To estimate 2012 oil sands workforce, 2011 headcount information was appropriated based on oil sands production increases identified by CAPP's Crude Oil Forecast and Market Outlook.

Employment Driver Data Sources

The Canadian Association of Petroleum Producers (CAPP) is the information source for oil and gas production forecasts as well as past years' actual capital and operations expenditures. CAPP's *Crude Oil Forecast and Market Outlook* is released in June

of each year. Their natural gas production forecast is updated periodically through the year. Actual E&P capital and operations expenditure information is available through CAPP every August/September.

For E&P and Oil and Gas Services

FirstEnergy Capital Corp. was hired to develop a most likely price scenario and conventional capital and operations expenditure forecasts.

Once production and pricing have been forecasted, **conventional capital expenditures** are determined by: calculating cash flow using forecasted price and forecasted production, then multiplying cash flow by a reinvestment ratio.

Conventional operating costs per barrel of oil (BOE) are then calculated using the historical data from CAPP divided by production. Operating costs per BOE are then escalated by a cost adjustment factor in the forecast period dependent on the pricing scenario. Higher industry activity levels tend to result in higher cost inflation.

For Oil Sands

The model projects oil sands occupations' workforce demand using Canadian Association of Petroleum Producers (CAPP's) annual crude oil production forecast. The labour market modeling can project employment and hiring requirements by each operation-type (i.e., mining, in situ and upgrading) since historical employment numbers and production forecast are also available by operation-type.

The timing of oil sands employment needs aligns with production output. Note that actual hiring of workers often precedes the employment driver – oil sands companies may ramp up hiring (six to 12 months in advance of when additional production is scheduled to come on stream) particularly if the labour market is tight.

For Pipelines

The model projects pipeline occupations' employment requirements using operating expenditures for conventional E&P and oil sands, which were provided by FirstEnergy Capital Corp.

Hiring Due to Age-related Attrition

The labour modeling system also compares occupation-specific age of retirement to the age demographic of each core occupation to calculate age-related attrition rates of the industry's workforce.

The number of job openings due to age-related attrition is added to the number of jobs created (or lost) due to industry activity to determine **net hiring requirements.**

Hiring Due to 3% Non-retirement Turnover

The Petroleum HR Council applied 3% to the total projected year-over-year employment minus age-related attrition to estimate non-retirement turnover. The end result is the number of job openings due to employee movement between positions, companies and/or industries. Hiring due to industry expansion + age-related attrition + 3% non-retirement turnover is referred to as **total hiring outlook.**

Labour Supply and Supply-Demand Gaps

The modeling system projects potential labour supply available to the industry as a whole. It is not possible to determine labour supply for a specific industry sector due to movement of workers between sectors (e.g., a petroleum engineer may be employed by the E&P, services or oil sands sectors).

The model 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 workers (by its offer of employment or labour demand) amidst competition from other industries. Two labour supply sources are considered:

- **New entrants:** workers entering the labour force for the first time.
- **In-mobility:** workers that are changing careers part way through their work life, including changing industries, occupations and immigration into Canada (not international recruitment or temporary foreign workers).

Labour supply-demand gaps are assessed by comparing projected unemployment rates for each occupation and total industry with what is considered to be the balanced unemployment rate for the occupation or industry overall. For total industry, the balanced unemployment rate is determined at 6%. A labour surplus is assumed if the projected unemployment rate is above the balanced unemployment rate. Conversely, a labour shortage is expected if the unemployment rate falls below the balanced rate. The balanced unemployment rate for each core occupation differs and is detailed in Appendix 6.

APPENDIX 2: SAMPLE JOB TITLES

Occupation (NOC Code)	Oil and Gas Services Job Titles	Conventional E&P Job Titles	Oil Sands Job Titles	Pipeline Job Titles
Chemical engineering technologists (2211)	Field technician, field operations technologist	Chemical engineering technologist, production technologist, reservoir technologist, quality assurance analyst	Process technician, chemical engineering technologist, quality assurance analyst, lab technician	Pipeline integrity technician, corrosion specialist
Chemical engineers (2134)	Field engineer, drilling engineer, well engineer, measurement while drilling specialist, technical engineer	Production engineer, reservoir engineer, reliability engineer, drilling and completions engineer, exploitation engineer	Chemical engineer, process engineer	Pipeline engineer, inspection engineer, pipeline integrity engineer, corrosion engineer
Civil engineers (2131)	Civil engineer, project engineer	Civil engineer, project engineer	Civil engineer, geotechnical engineer, piping engineer, project engineer	Pipeline engineer, inspection engineer, pipeline integrity engineer, project engineer
Crane operators (7371)	Crane operator	Crane operator	Crane operator, mobile crane operator	Crane operator
Drafting technologists and technicians (2253)	Drafting technologist, CAD technologist	Drafting technologist, CAD technologist	Drafting technologist, CAD technologist	Pipeline design technologist, piping technologist, drafting technologist, CAD technologist
Drilling coordinators/ production managers (0811)	Drilling coordinator, production engineer, production manager	Drilling coordinator, production engineer, production manager, field manager	Production manager, drilling manager, operations manager	Pipeline operations manager
Electrical/ instrumentation engineers (2133)	Electrical engineer, instrumentation engineer	Electrical/instrumentation engineer, project engineer	Electrical/instrumentation engineer, project engineer, electrical/instrumentation reliability engineer, control systems specialist	Electrical/instrumentation engineer, project engineer
Environmental technicians (4161)	Environmental technician	Environmental technician	Environmental technician	Environmental technician
Geologists and geophysicists (2113)	Geologist, geophysicist	Geologist, geophysicist	Geologist, geophysicist	Geologist, geophysicist
Heavy equipment operators (except crane) (7421)	Heavy equipment operator	Heavy equipment operator	Heavy equipment operator	Heavy equipment operator
Heavy-duty equipment mechanics (7312)	Heavy-duty mechanic, heavy-duty technician	Heavy-duty mechanic, heavy-duty technician	Heavy-duty mechanic	Heavy-duty mechanic
Industrial and manufacturing engineer (2141)	Project engineer, quality control engineer	Project engineer, quality control engineer, optimization engineer	Project engineer, quality control engineer, optimization engineer	Project engineer, quality control engineer, optimization engineer
Industrial electricians (7242)	Industrial electrician, electrician, electrical technician	Industrial electrician, electrician, electrical technician	Industrial electrician, electrician, electrical technician	Industrial electrician, electrician, electrical technician
Industrial engineering and manufacturing technologists and technicians (2233)	Industrial engineering technologist, engineering technologist	Industrial technician, engineering technologist	Rotating equipment technician, industrial technician	SCADA technician
Inspectors in public and environmental health and safety (2263)	Health & safety inspector, EH&S specialist, OHSE field advisor	Health & safety inspector, EH&S specialist	Health & safety inspector, EH&S specialist	Health & safety inspector, EH&S specialist
Instrumentation engineering technologists (2241)	Instrumentation technologist, instrumentation technician	DCS Specialist, DCS technician, instrumentation technologist/ technician	DCS Specialist, DCS technician, instrumentation technologist/ technician, instrumentation reliability technician	SCADA design technologist, SCADA technologist
Instrumentation technicians (2243)	Instrumentation technician/ mechanic, service technician, field services technician	DCS Specialist, DCS technician, Instrumentation technologist, Instrumentation technician	DCS Specialist, DCS technician, instrumentation technologist/ technician, instrumentation reliability technician	SCADA technician
Insulators (7293)	Insulators	Insulators	n/a	Insulators

Occupation (NOC Code)	Oil and Gas Services Job Titles	Conventional E&P Job Titles	Oil Sands Job Titles	Pipeline Job Titles
Machinists and machining and tooling inspectors (7231)	Machinist, CNC machinist	Machinist	Machinist	Machinist
Mechanical engineering technologists (2232)	Engineering technician, hydraulic technician, field operations technologist	Reservoir engineering technologist, reservoir technician, mechanical engineering technologist	Mechanical engineering technologist, rotating equipment technician/ technologist	Mechanical design technologist
Mechanical engineers (2132)	Technical engineer	Mechanical engineer, facilities engineer, production engineer, reservoir engineer, drilling and completions engineer, exploitation engineer, project engineer, rotating equipment engineer	Plant engineer, facilities engineer, rotating equipment engineer, mechanical reliability engineer	Pipeline Engineer, Inspection engineer, pipeline integrity engineer, facilities engineer, measurement engineer, project engineer
Millwrights (7311)	Millwright, maintenance mechanic	Millwright, rotating equipment mechanic	Millwright, mechanical reliability technician, rotating equipment mechanic	Millwright, maintenance technician
Mining engineers (2143)	Mining engineer	Mining engineer	Mining engineer	n/a
Non-destructive testers and inspection technicians (2261)	Quality assurance analyst, mechanical QA, QA/QC inspector, coordinator	Quality assurance analyst, NDT technician, NDT analyst	Quality assurance analyst, NDT technician, NDT analyst	Quality assurance analyst, measurement integrity analyst
Oil and gas drilling, servicing, and related labourers (8615)	Labourer, floorhand, leasehand, roustabout	Field labourer	Labourer	Field labourer, tank farm labourer
Oil and gas well drillers, servicers, testers, and related workers (8232)	Rig technician, cementer helper, fracturing operator trainee, tubing helper, production testing trainee, perforator helper, rigger, snubbing assistant operator, well puller helper, well testing helper, wireline helper/ operator trainee, loggers, testers	Production tester	n/a	Field workers
Oil and gas well drilling workers and service operators (8412)	Driller, derrickhand, motorhand, production well test operator, snubbing services operator, wireline operator, acidizing operator, pump servicer, power tong/casing operator, cementing operator, coil tubing operator, completion/ service tool operator, drill stem test operator, fishing tool operator, fracturing equipment operator, logging & coring operator, nitrogen operator, swabbing unit operator, fracturing operator, directional driller, measurement while drilling specialist, MWD operators, driller, rig technician	Field operator, production operator, well operator	n/a	Tank operator, pipeline locator
Petroleum engineers (2145)	Petroleum engineer, field engineer, production operations engineer, field operations engineer, technical engineer	Petroleum engineer, production engineer, reservoir engineer, drilling and completions engineer, exploitation engineer	Petroleum engineer, reservoir engineer, drilling and completions engineer	Petroleum engineer, reservoir engineer
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	Cementing plant operator, drilling fluids plant operator, bulk plant operator, plant operator	Plant operator, gas plant operator, field operator, production technician, battery operator	Process operator, plant operator, unit operator, bitumen operator	Control room operators, gas control operator, compressor operator, facilities operator, pipeline operator
Petroleum/mining/geological engineering technologists (2212)	Petroleum engineering technologist, technical specialists (fracturing, coil tubing, etc.), engineering technician, measurement while drilling specialist, field specialist	Petroleum engineering technologist, reservoir technologist, geological technologist, production technician	Mining engineering technologist, petroleum engineering technologist	Geological technician, geological surveyor, welding technologist, metallurgical technologist

Occupation (NOC Code)	Oil and Gas Services Job Titles	Conventional E&P Job Titles	Oil Sands Job Titles	Pipeline Job Titles
Power engineers (steam-ticket required) (7351)	Process operator, power engineer, steam-ticketed operators, cementing plant operator, drilling fluids plant operator, 5th class power engineer,	Plant operator, gas plant operator, field operator, production technician, 1st, 2nd, 3rd and 4th Class power engineer	Control room operator, process operator, bitumen plant operator, SAGD operator, in situ operator, production technician, unit operator, 1st, 2nd, 3rd and 4th Class power engineer	n/a
Production clerks (1473)	Production clerk	Production accountant, production clerk	Production accountant, production technician	Production accountants, oil/gas scheduler, pipeline scheduler, measurement technician
Purchasing agents and officers (1225)	Purchaser, materials coordinator, buyer, procurement	Landman, contract administrator, contract manager, contract specialist, procurement specialist, buyer	Contract administrator, contract manager, contract specialist, procurement specialist, buyer, purchaser	Contract administrator, contract manager, contract specialist, buyer, procurement specialist
Steamfitters and pipefitters (7252)	Steamfitter/pipefitter	Steamfitter/pipefitter	Steamfitter, pipefitter	Pipefitter, steamfitter
Supervisors, oil and gas drilling and service (8222)	Rig manager, service rig manager, field supervisor, fracturing supervisor, drilling rig manager, seismic field operations supervisor	Drilling superintendent, completions supervisor	n/a	n/a
Supervisors, petroleum, gas and chemical processing and utilities (9212)	Petroleum field supervisor, blending plant supervisor, water treatment supervisor, pumping and blending supervisor	Supervisor, gas plant facilities manager, operations manager	n/a	Pipeline supervisor, pipeline operations supervisor, transmission supervisor
Truck drivers (7411)	Transportation operators, Class 1 truck driver, Class 3 truck driver	Truck driver	n/a	Truck drivers, transport operators
Welders (7265)	Welder, B-pressure welder	Welder	Welder	Welder
Other occupations	Includes occupations in human resources, accounting and finance, IT, administrative assistance, legal and other corporate services.	Includes occupations in human resources, accounting and finance, IT, administrative assistance, legal and other corporate services.	Includes occupations in human resources, accounting and finance, IT, administrative assistance, legal and other corporate services.	Includes occupations in human resources, accounting and finance, IT, administrative assistance, legal and other corporate services.

APPENDIX 3: CANADA-WIDE NET HIRING REQUIREMENTS BY OCCUPATION TO 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**195,223**	**18,280 – 38,705**	**44,154 – 45,318**	**62,434 – 84,023**
Chemical engineering technologists (2211)	881	79 – 180	176 – 184	255 – 364
Chemical engineers (2134)	960	213 – 373	206 – 210	419 – 583
Civil engineers (2131)	444	39 – 92	106 – 108	145 – 200
Crane operators (7371)	630	51 – 109	154 – 155	205 – 264
Drafting technologists and technicians (2253)	383	84 – 151	95 – 97	179 – 248
Drilling coordinators/ production managers (0811)	6,764	989 – 1,822	2,063 – 2,122	3,052 – 3,944
Electrical/instrumentation engineers (2133)	701	212 – 359	165 – 170	377 – 529
Environmental technicians (4161)	362	92 – 155	76 – 78	168 – 233
Geologists and geophysicists (2113)	4,721	382 – 933	1,333 – 1,372	1,715 – 2,305
Heavy equipment operators (except crane) (7421)	7,079	861 – 2,371	1,566 – 1,618	2,427 – 3,989
Heavy-duty equipment mechanics (7312)	2,262	394 – 854	512 – 531	906 – 1,385
Industrial and manufacturing engineer (2141)	563	221 – 349	138 – 142	359 – 491
Industrial electricians (7242)	1,951	305 – 609	466 – 478	771 – 1,087
Industrial engineering and manufacturing technologists and technicians (2233)	255	34 – 67	74 – 75	108 – 142
Inspectors in public and environmental health and safety (2263)	1,451	189 – 358	419 – 428	608 – 786
Instrumentation engineering technologists (2241)	687	120 – 207	161 – 166	281 – 373
Instrumentation technicians (2243)	1,585	309 – 548	355 – 366	664 – 914
Insulators (7293)	609	74 – 129	132 – 137	206 – 266
Machinists and machining and tooling inspectors (7231)	904	83 – 164	194 – 197	277 – 361
Mechanical engineering technologists (2232)	447	119 – 200	96 – 99	215 – 299
Mechanical engineers (2132)	1,387	293 – 530	316 – 325	609 – 855
Millwrights (7311)	4,256	396 – 834	912 – 937	1,308 – 1,771
Mining engineers (2143)	193	24 – 84	42 – 43	66 – 127
Non-destructive testers and inspection technicians (2261)	641	148 – 242	161 – 166	309 – 408

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Oil and gas drilling, servicing, and related labourers (8615)	12,938	1,003 – 2,004	1,410 – 1,476	2,413 – 3,480
Oil and gas well drillers, servicers, testers, and related workers (8232)	12,307	1,036 – 2,011	1,908 – 1,974	2,944 – 3,985
Oil and gas well drilling workers and service operators (8412)	9,032	639 – 1,324	1,222 – 1,268	1,861 – 2,592
Petroleum engineers (2145)	6,862	489 – 1,206	1,660 – 1,702	2,149 – 2,908
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	7,139	(-191) – 263	1,604 – 1,634	1,413 – 1,897
Petroleum/mining/ geological engineering technologists (2212)	2,799	365 – 697	673 – 697	1,038 – 1,394
Power engineers (steam-ticket required) (7351)	4,943	1,816 – 2,945	1,130 – 1,162	2,946 – 4,107
Production clerks (1473)	857	(-35) – 0	198 – 200	163 –200
Purchasing agents and officers (1225)	1,875	256 – 503	516 – 532	772 – 1,035
Steamfitters and pipefitters (7252)	2,544	213 – 444	500 – 515	713 – 959
Supervisors, oil and gas drilling and service (8222)	9,570	429 – 1,093	2,501 – 2,549	2,930 – 3,642
Supervisors, petroleum, gas and chemical processing and utilities (9212)	1,416	(-76) – (-13)	450 – 455	374 – 442
Truck drivers (7411)	6,440	793 – 1,376	1,408 – 1,448	2,201 – 2,824
Welders (7265)	3,428	394 – 762	693 – 713	1,087 – 1,475
Other occupations	72,957	5,441 – 12,379	18,360 – 18,793	23,801 – 31,172

APPENDIX 4: OCCUPATIONAL NET HIRING REQUIREMENTS TO 2022 BY INDUSTRY SECTOR

Oil and Gas Services Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**94,058**	**16,366 – 25,851**	**21,307 – 22,020**	**37,687 – 47,869**
Chemical engineering technologists (2211)	271	48 – 74	56 – 59	104 – 133
Chemical engineers (2134)	120	20 – 34	26 – 26	46 – 59
Civil engineers (2131)	125	21 – 34	30 – 32	53 – 66
Crane operators (7371)	371	63 – 102	94 – 97	159 – 199
Drafting technologists and technicians (2253)	165	29 – 45	40 – 40	69 – 87
Drilling coordinators/ production managers (0811)	4,140	720 – 1,138	1,270 – 1,299	1,992 – 2,437
Electrical/ instrumentation engineers (2133)	185	32 – 52	40 – 44	74 – 93
Environmental technicians (4161)	70	12 – 20	15 – 15	26 – 34
Geologists and geophysicists (2113)	1,709	297 – 469	502 – 511	798 – 981
Heavy equipment operators (except crane) (7421)	3,263	568 – 897	730 – 746	1,297 – 1,643
Heavy-duty equipment mechanics (7312)	1,173	204 – 323	263 – 271	467 – 592
Industrial and manufacturing engineer (2141)	145	26 – 40	30 – 35	58 – 74
Industrial electricians (7242)	807	141 – 222	193 – 200	333 – 420
Industrial engineering and manufacturing technologists and technicians (2233)	95	17 – 27	29 – 29	44 – 55
Inspectors in public and environmental health and safety (2263)	692	121 – 190	203 – 209	324 – 399
Instrumentation engineering technologists (2241)	366	63 – 101	87 – 88	150 – 190
Instrumentation technicians (2243)	496	86 – 137	111 – 114	197 – 251
Insulators (7293)	506	87 – 139	113 – 117	202 – 256
Machinists and machining and tooling inspectors (7231)	607	107 – 167	136 – 139	241 – 306
Mechanical engineering technologists (2232)	190	33 – 52	38 – 41	73 – 93
Mechanical engineers (2132)	396	68 – 109	89 – 91	158 – 200
Millwrights (7311)	2,215	386 – 608	497 – 513	883 – 1,123
Mining engineers (2143)	25	4 – 6	6 – 7	10 – 12

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Non-destructive testers and inspection technicians (2261)	366	63 – 101	89 – 91	153 – 193
Oil and gas drilling, servicing, and related labourers (8615)	9,082	1,582 – 2,496	1,048 – 1,107	2,629 – 3,603
Oil and gas well drillers, servicers, testers, and related workers (8232)	8,958	1,559 – 2,462	1,464 – 1,526	3,023 – 3,988
Oil and gas well drilling workers and service operators (8412)	6,187	1,076 – 1,698	889 – 932	1,967 – 2,632
Petroleum engineers (2145)	1,519	263 – 418	387 – 398	652 – 816
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	1,489	259 – 409	375 – 389	635 – 799
Petroleum/mining/ geological engineering technologists (2212)	1,238	215 – 340	303 – 313	518 – 653
Power engineers (steam-ticket required) (7351)	110	20 – 31	23 – 25	42 – 54
Production clerks (1473)	165	29 – 45	45 – 46	72 – 91
Purchasing agents and officers (1225)	491	86 – 136	136 – 141	223 – 275
Steamfitters and pipefitters (7252)	1,604	279 – 441	331 – 343	610 – 783
Supervisors, oil and gas drilling and service (8222)	5,791	1,007 – 1,590	1,627 – 1,679	2,637 – 3,271
Supervisors, petroleum, gas and chemical processing and utilities (9212)	416	73 – 115	149 – 155	223 – 270
Truck drivers (7411)	5,278	918 – 1,451	1,185 – 1,223	2,105 – 2,673
Welders (7265)	2,376	413 – 652	495 – 510	908 – 1,164
Other occupations	30,854	5,371 – 8,480	8,163 – 8,419	13,533 – 16,899

Conventional E&P Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**72,003**	**(-8,321) – (-4,699)**	**15,168 – 15,410**	**6,831 – 10,701**
Chemical engineering technologists (2211)	416	(-36) – (-6)	77 – 78	40 – 73
Chemical engineers (2134)	251	(-20) – 0	47 – 48	26 – 48
Civil engineers (2131)	214	(-13) – 2	48 – 48	33 – 50
Crane operators (7371)	207	(-25) – (-16)	45 – 46	18 – 28
Drafting technologists and technicians (2253)	73	(-2) – 5	19 – 19	12 – 21

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Drilling coordinators/ production managers (0811)	2,004	(-41) – 199	575 – 602	533 – 802
Electrical/instrumentation engineers (2133)	46	(-5) – (-1)	10 – 10	5 – 8
Environmental technicians (4161)	112	(-11) – (-4)	20 – 20	8 – 16
Geologists and geophysicists (2113)	2,654	(-123) – 142	712 – 737	587 – 879
Heavy equipment operators (except crane) (7421)	720	(-101) – (-76)	135 – 135	33 – 58
Heavy-duty equipment mechanics (7312)	80	(-11) – (-7)	12 – 14	4 – 6
Industrial and manufacturing engineer (2141)	3	0 – 0	0 – 0	0 – 0
Industrial electricians (7242)	449	(-29) – 11	96 – 100	70 – 112
Industrial engineering and manufacturing technologists and technicians (2233)	106	(-9) – 0	30 – 30	19 – 28
Inspectors in public and environmental health and safety (2263)	523	(-52) – (-16)	136 – 137	84 – 119
Instrumentation engineering technologists (2241)	134	(-12) – (-3)	30 – 30	16 – 24
Instrumentation technicians (2243)	416	(-55) – (-39)	78 – 78	24 – 41
Insulators (7293)	103	(-15) – (-11)	20 – 20	5 – 9
Machinists and machining and tooling inspectors (7231)	239	(-33) – (-26)	42 – 44	10 – 19
Mechanical engineering technologists (2232)	35	(-5) – (-2)	10 – 10	3 – 6
Mechanical engineers (2132)	303	(-25) – (-5)	58 – 59	34 – 57
Millwrights (7311)	1,358	(-188) – (-143)	255 – 256	64 – 113
Mining engineers (2143)	15	0 – 2	0 – 0	3 – 5
Non-destructive testers and inspection technicians (2261)	55	(-8) – (-6)	10 – 10	4 – 6
Oil and gas drilling, servicing, and related labourers (8615)	3,771	(-596) – (-513)	353 – 359	(-242) – (-156)
Oil and gas well drillers, servicers, testers, and related workers (8232)	3,333	(-525) – (-456)	442 – 445	(-83) – (-10)
Oil and gas well drilling workers and service operators (8412)	2,813	(-445) – (-381)	329 – 330	(-115) – (-52)
Petroleum engineers (2145)	4,332	(-375) – (-71)	971 – 995	596 – 922

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	4,602	(-656) – (-511)	967 – 975	312 – 463
Petroleum/mining/ geological engineering technologists (2212)	1,250	(-63) – 58	278 – 291	215 – 349
Power engineers (steam-ticket required) (7351)	1,018	(-144) – (-113)	180 – 179	35 – 67
Production clerks (1473)	557	(-88) – (-78)	120 – 120	32 – 42
Purchasing agents and officers (1225)	1,057	(-44) – 65	272 – 282	226 – 347
Steamfitters and pipefitters (7252)	756	(-105) – (-81)	130 – 130	26 – 51
Supervisors, oil and gas drilling and service (8222)	3,731	(-591) – (-511)	862 – 854	269 – 344
Supervisors, petroleum, gas and chemical processing and utilities (9212)	976	(-153) – (-131)	291 – 290	135 – 155
Truck drivers (7411)	1,097	(-137) – (-91)	209 – 210	73 – 120
Welders (7265)	690	(-97) – (-73)	120 – 120	24 – 47
Other occupations	31,509	(-3,483) – (-1,812)	7,179 – 7,299	3,693 – 5,484

Oil Sands Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**22,342**	**8,878 – 15,943**	**6,011 – 6,228**	**14,898 – 22,182**
Chemical engineering technologists (2211)	145	59 –102	34 – 35	93 – 137
Chemical engineers (2134)	459	186 – 311	108 – 111	294 – 420
Civil engineers (2131)	64	24 – 45	18 – 18	42 – 64
Crane operators (7371)	36	8 – 22	10 – 10	18 – 31
Drafting technologists and technicians (2253)	129	56 – 95	36 – 36	91 – 133
Drilling coordinators/ production managers (0811)	571	298 – 475	203 – 208	501 – 684
Electrical/instrumentation engineers (2133)	437	177 – 303	108 – 111	285 – 414
Environmental technicians (4161)	147	83 – 130	35 – 36	120 – 168
Geologists and geophysicists (2113)	357	207 – 322	123 – 127	327 – 447
Heavy equipment operators (except crane) (7421)	3,055	384 – 1,540	694 – 731	1,078 – 2,269
Heavy-duty equipment mechanics (7312)	986	196 – 533	230 – 240	428 – 775

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Industrial and manufacturing engineer (2141)	350	184 – 292	91 – 95	276 – 388
Industrial electricians (7242)	565	167 – 345	144 – 150	311 – 493
Industrial engineering and manufacturing technologists and technicians (2233)	38	25 – 36	12 – 13	36 – 50
Inspectors in public and environmental health and safety (2263)	220	115 – 181	76 – 79	189 – 257
Instrumentation engineering technologists (2241)	122	56 – 93	32 – 34	90 – 130
Instrumentation technicians (2243)	559	256 – 423	141 – 146	398 – 571
Insulators (7293)	-	0 – 0	0 – 0	0 – 0
Machinists and machining and tooling inspectors (7231)	42	7 – 16	10 – 10	17 – 26
Mechanical engineering technologists (2232)	189	82 – 141	45 – 47	126 – 187
Mechanical engineers (2132)	575	226 – 397	143 – 148	370 – 546
Millwrights (7311)	521	166 – 332	126 – 133	293 – 465
Mining engineers (2143)	154	21 – 76	34 – 34	54 – 111
Non-destructive testers and inspection technicians (2261)	188	85 – 141	52 – 53	135 – 193
Oil and gas drilling, servicing, and related labourers (8615)	4	0 – 0	0 – 0	1 – 1
Oil and gas well drillers, servicers, testers, and related workers (8232)	-	0 – 0	0 – 0	0 – 0
Oil and gas well drilling workers and service operators (8412)	-	0 – 0	0 – 0	0 – 0
Petroleum engineers (2145)	809	559 – 810	252 – 259	812 – 1,070
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	359	72 – 201	94 – 100	165 – 302
Petroleum/mining/ geological engineering technologists (2212)	262	199 – 285	79 – 81	281 – 367
Power engineers (steam-ticket required) (7351)	3,815	1,943 – 3,028	928 – 958	2,870 – 3,986
Production clerks (1473)	5	1 – 1	0 – 0	1 – 4
Purchasing agents and officers (1225)	263	200 – 286	91 – 93	294 – 379
Steamfitters and pipefitters (7252)	144	31 – 73	29 – 32	61 – 105

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Supervisors, oil and gas drilling and service (8222)	-	0 – 0	0 – 0	0 – 0
Supervisors, petroleum, gas and chemical processing and utilities (9212)	-	0 – 0	0 – 0	0 – 0
Truck drivers (7411)	-	0 – 0	0 – 0	0 – 0
Welders (7265)	321	69 – 175	69 – 73	139 – 249
Other occupations	6,449	2,736 – 4,733	1,964 – 2,027	4,702 – 6,760

Pipeline Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**6,821**	**1,340 – 1,617**	**1,656 – 1,648**	**3,007 – 3,271**
Chemical engineering technologists (2211)	49	10 – 11	10 – 10	19 – 21
Chemical engineers (2134)	130	24 – 30	26 – 26	52 – 57
Civil engineers (2131)	41	10 – 10	10 – 10	18 – 19
Crane operators (7371)	16	0 – 1	0 – 0	7 – 8
Drafting technologists and technicians (2253)	16	0 – 1	0 – 0	7 – 8
Drilling coordinators/ production managers (0811)	49	10 – 11	12 – 11	24 – 26
Electrical/instrumentation engineers (2133)	32	9 – 9	10 – 10	13 – 15
Environmental technicians (4161)	32	9 – 9	9 – 9	13 – 14
Geologists and geophysicists (2113)	-	0 – 0	0 – 0	0 – 0
Heavy equipment operators (except crane) (7421)	41	10 – 10	10 – 10	17 – 18
Heavy-duty equipment mechanics (7312)	24	3 – 8	6 – 6	10 – 11
Industrial and manufacturing engineer (2141)	65	13 – 17	12 – 11	27 – 29
Industrial electricians (7242)	130	24 – 30	30 – 30	55 – 60
Industrial engineering and manufacturing technologists and technicians (2233)	16	0 – 1	1 – 1	8 – 8
Inspectors in public and environmental health and safety (2263)	16	0 – 1	0 – 0	8 – 8
Instrumentation engineering technologists (2241)	65	13 – 17	13 – 13	27 – 30

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Instrumentation technicians (2243)	113	23 – 29	25 – 25	47 – 51
Insulators (7293)	-	0 – 0	0 – 0	0 – 0
Machinists and machining and tooling inspectors (7231)	16	0 – 1	0 – 0	7 – 7
Mechanical engineering technologists (2232)	32	9 – 9	10 – 10	13 – 14
Mechanical engineers (2132)	113	23 – 29	24 – 24	47 – 51
Millwrights (7311)	162	32 – 39	35 – 35	67 – 73
Mining engineers (2143)	-	0 – 0	0 – 0	0 – 0
Non-destructive testers and inspection technicians (2261)	32	9 – 9	10 – 10	14 – 15
Oil and gas drilling, servicing, and related labourers (8615)	81	15 – 19	10 – 10	25 – 28
Oil and gas well drillers, servicers, testers, and related workers (8232)	16	0 – 1	0 – 0	6 – 6
Oil and gas well drilling workers and service operators (8412)	32	9 – 9	3 – 3	11 – 12
Petroleum engineers (2145)	203	40 – 48	51 – 50	90 – 97
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	689	135 – 164	167 – 167	303 – 330
Petroleum/mining/ geological engineering technologists (2212)	49	10 – 11	10 – 10	21 – 23
Power engineers (steam-ticket required) (7351)	-	0 – 0	0 – 0	0 – 0
Production clerks (1473)	130	24 – 30	33 – 33	58 – 64
Purchasing agents and officers (1225)	65	13 – 17	20 – 20	30 – 33
Steamfitters and pipefitters (7252)	41	10 – 10	10 – 10	16 – 18
Supervisors, oil and gas drilling and service (8222)	49	10 – 11	11 – 11	23 – 25
Supervisors, petroleum, gas and chemical processing and utilities (9212)	24	3 – 8	10 – 10	13 – 14
Truck drivers (7411)	65	13 – 17	12 – 12	27 – 29
Welders (7265)	41	10 – 10	10 – 10	16 – 18
Other occupations	4,146	817 – 980	1,056 – 1,051	1,871 – 2,030

APPENDIX 5: OCCUPATIONAL NET HIRING REQUIREMENTS TO 2022 BY PROVINCE

British Columbia-based Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**12,017**	**641 – 1,597**	**2,451 – 2,513**	**3,092 – 4,109**
Chemical engineering technologists (2211)	40	4 – 8	8 – 8	12 – 16
Chemical engineers (2134)	33	5 – 7	7 – 7	12 – 14
Civil engineers (2131)	18	3 – 4	4 – 5	7 – 9
Crane operators (7371)	70	3 – 8	17 – 17	19 – 25
Drafting technologists and technicians (2253)	19	2 – 4	5 – 5	7 – 9
Drilling coordinators/ production managers (0811)	429	51 – 96	131 – 134	181 – 230
Electrical/instrumentation engineers (2133)	23	3 – 5	5 – 5	8 – 11
Environmental technicians (4161)	23	1 – 2	4 – 4	5 – 6
Geologists and geophysicists (2113)	167	20 – 38	49 – 50	69 – 88
Heavy equipment operators (except crane) (7421)	464	36 – 78	100 – 102	136 – 181
Heavy-duty equipment mechanics (7312)	148	16 – 31	33 – 33	49 – 64
Industrial and manufacturing engineer (2141)	15	3 – 3	3 – 3	6 – 7
Industrial electricians (7242)	177	11 – 27	41 – 42	52 – 69
Industrial engineering and manufacturing technologists and technicians (2233)	12	1 – 3	4 – 4	5 – 7
Inspectors in public and environmental health and safety (2263)	76	6 – 14	22 – 22	28 – 36
Instrumentation engineering technologists (2241)	48	6 – 10	11 – 11	17 – 22
Instrumentation technicians (2243)	123	4 – 13	26 – 26	29 – 39
Insulators (7293)	70	5 – 12	15 – 16	21 – 28
Machinists and machining and tooling inspectors (7231)	99	5 – 14	21 – 22	26 – 35
Mechanical engineering technologists (2232)	24	3 – 5	5 – 5	8 – 10
Mechanical engineers (2132)	58	8 – 13	13 – 13	21 – 26
Millwrights (7311)	434	14 – 47	91 – 93	106 – 141
Mining engineers (2143)	2	0 – 1	1 – 1	1 – 1

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Non-destructive testers and inspection technicians (2261)	38	4 – 8	9 – 9	13 – 17
Oil and gas drilling, servicing, and related labourers (8615)	1,463	66 – 186	159 – 167	225 – 353
Oil and gas well drillers, servicers, testers, and related workers (8232)	1,392	70 – 187	216 – 223	285 – 410
Oil and gas well drilling workers and service operators (8412)	1,020	40 – 122	138 – 143	178 – 266
Petroleum engineers (2145)	208	22 – 41	52 – 53	73 – 94
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	796	(-33) – 6	178 – 180	145 – 186
Petroleum/mining/ geological engineering technologists (2212)	147	15 – 30	35 – 37	51 – 67
Power engineers (steam-ticket required) (7351)	128	(-15) – (-10)	23 – 23	8 – 13
Production clerks (1473)	19	4 – 5	5 – 5	9 – 10
Purchasing agents and officers (1225)	33	5 – 7	9 – 9	14 – 16
Steamfitters and pipefitters (7252)	277	12 – 34	54 – 56	66 – 90
Supervisors, oil and gas drilling and service (8222)	941	3 – 69	244 – 248	247 – 317
Supervisors, petroleum, gas and chemical processing and utilities (9212)	147	(-11) – (-5)	46 – 47	35 – 42
Truck drivers (7411)	749	60 – 130	163 – 168	223 – 298
Welders (7265)	359	24 – 55	72 – 74	95 – 129
Other occupations	1,728	165 – 286	435 – 442	601 – 729

Alberta-based Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**159,419**	**17,091 – 34,969**	**36,715 – 37,728**	**53,806 – 72,697**
Chemical engineering technologists (2211)	749	71 – 162	151 – 157	222 – 319
Chemical engineers (2134)	840	197 – 351	181 – 186	378 – 537
Civil engineers (2131)	377	33 – 79	90 – 92	123 – 171
Crane operators (7371)	453	46 – 91	111 – 113	156 – 205
Drafting technologists and technicians (2253)	327	79 – 139	81 – 84	161 – 223

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Drilling coordinators/ production managers (0811)	5,570	878 – 1,594	1,705 – 1,757	2,583 – 3,351
Electrical/instrumentation engineers (2133)	635	204 – 347	151 – 156	355 – 503
Environmental technicians (4161)	297	90 – 148	63 – 65	153 – 213
Geologists and geophysicists (2113)	4,125	344 – 838	1,166 – 1,201	1,511 – 2,038
Heavy equipment operators (except crane) (7421)	5,931	790 – 2,204	1,322 – 1,369	2,112 – 3,574
Heavy-duty equipment mechanics (7312)	1,901	361 – 787	434 – 450	795 – 1,237
Industrial and manufacturing engineer (2141)	510	213 – 337	127 – 131	341 – 468
Industrial electricians (7242)	1,505	277 – 542	364 – 374	641 – 916
Industrial engineering and manufacturing technologists and technicians (2233)	213	31 – 59	61 – 63	93 – 122
Inspectors in public and environmental health and safety (2263)	1,226	177 – 327	354 – 363	531 – 690
Instrumentation engineering technologists (2241)	550	106 – 181	130 – 134	236 – 315
Instrumentation technicians (2243)	1,255	301 – 517	288 – 297	588 – 814
Insulators (7293)	437	63 – 103	96 – 99	159 – 202
Machinists and machining and tooling inspectors (7231)	653	74 – 135	141 – 144	216 – 279
Mechanical engineering technologists (2232)	380	110 – 186	83 – 86	193 – 272
Mechanical engineers (2132)	1,205	271 – 496	277 – 285	548 – 781
Millwrights (7311)	3,131	371 – 734	680 – 698	1,051 – 1,433
Mining engineers (2143)	186	24 – 82	40 – 41	64 – 124
Non-destructive testers and inspection technicians (2261)	537	137 – 225	136 – 140	273 – 365
Oil and gas drilling, servicing, and related labourers (8615)	9,227	908 – 1,637	1,013 – 1,060	1,921 – 2,698
Oil and gas well drillers, servicers, testers, and related workers (8232)	8,800	931 – 1,642	1,375 – 1,422	2,305 – 3,064
Oil and gas well drilling workers and service operators (8412)	6,441	589 – 1,088	878 – 911	1,467 – 1,999
Petroleum engineers (2145)	6,025	459 – 1,109	1,460 – 1,498	1,919 – 2,607

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	4,914	(-101) – 252	1,110 – 1,131	1,009 – 1,383
Petroleum/mining/ geological engineering technologists (2212)	2,352	333 – 623	567 – 588	900 – 1,212
Power engineers (steam-ticket required) (7351)	4,594	1,859 – 2,974	1,068 – 1,099	2,927 – 4,074
Production clerks (1473)	737	(-42) – (-12)	169 – 171	127 – 159
Purchasing agents and officers (1225)	1,698	245 – 475	469 – 485	714 – 959
Steamfitters and pipefitters (7252)	1,842	194 – 373	366 – 376	560 – 749
Supervisors, oil and gas drilling and service (8222)	7,051	461 – 971	1,858 – 1,895	2,319 – 2,866
Supervisors, petroleum, gas and chemical processing and utilities (9212)	1,006	(-42) – 5	321 – 325	279 – 330
Truck drivers (7411)	4,599	675 – 1,098	1,013 – 1,042	1,688 – 2,140
Welders (7265)	2,534	349 – 648	516 – 532	865 – 1,180
Other occupations	64,606	5,024 – 11,422	16,301 – 16,705	21,324 – 28,127

Saskatchewan-based Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**11,604**	**298 – 1,089**	**2,315 – 2,360**	**2,613 – 3,449**
Chemical engineering technologists (2211)	35	3 – 6	7 – 7	10 – 13
Chemical engineers (2134)	30	4 – 6	6 – 6	10 – 12
Civil engineers (2131)	16	2 – 3	4 – 4	6 – 7
Crane operators (7371)	68	1 – 6	16 – 16	17 – 22
Drafting technologists and technicians (2253)	18	2 – 3	4 – 4	6 – 8
Drilling coordinators/production managers (0811)	385	37 – 73	115 – 117	153 – 190
Electrical/instrumentation engineers (2133)	20	2 – 4	5 – 5	7 – 9
Environmental technicians (4161)	21	0 – 2	4 – 4	4 – 6
Geologists and geophysicists (2113)	151	15 – 29	43 – 44	58 – 73
Heavy equipment operators (except crane) (7421)	437	22 – 57	93 – 94	114 – 150
Heavy-duty equipment mechanics (7312)	135	11 – 23	29 – 30	41 – 53
Industrial and manufacturing engineer (2141)	13	2 – 3	3 – 3	5 – 6
Industrial electricians (7242)	159	8 – 22	36 – 37	44 – 58

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Industrial engineering and manufacturing technologists and technicians (2233)	11	1 – 2	3 – 3	4 – 6
Inspectors in public and environmental health and safety (2263)	69	4 – 10	20 – 20	24 – 30
Instrumentation engineering technologists (2241)	42	5 – 8	10 – 10	14 – 18
Instrumentation technicians (2243)	120	1 – 8	24 – 25	25 – 33
Insulators (7293)	66	3 – 9	14 – 14	17 – 23
Machinists and machining and tooling inspectors (7231)	96	2 – 9	20 – 20	22 – 30
Mechanical engineering technologists (2232)	21	2 – 4	4 – 4	7 – 9
Mechanical engineers (2132)	52	6 – 10	11 – 11	17 – 22
Millwrights (7311)	426	3 – 31	88 – 89	90 – 120
Mining engineers (2143)	2	0 – 0	0 – 0	1 – 1
Non-destructive testers and inspection technicians (2261)	34	3 – 6	8 – 8	11 – 14
Oil and gas drilling, servicing, and related labourers (8615)	1,440	19 – 118	153 – 159	172 – 277
Oil and gas well drillers, servicers, testers, and related workers (8232)	1,363	25 – 121	206 – 212	231 – 332
Oil and gas well drilling workers and service operators (8412)	1,009	8 – 75	133 – 137	141 – 212
Petroleum engineers (2145)	188	16 – 31	46 – 47	62 – 79
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	835	(-51) – (-15)	184 – 186	133 – 172
Petroleum/mining/ geological engineering technologists (2212)	132	11 – 23	31 – 32	43 – 55
Power engineers (steam-ticket required) (7351)	142	(-17) – (-12)	25 – 26	8 – 13
Production clerks (1473)	17	3 – 4	4 – 4	8 – 8
Purchasing agents and officers (1225)	28	4 – 6	8 – 8	12 – 14
Steamfitters and pipefitters (7252)	269	4 – 23	51 – 53	55 – 75
Supervisors, oil and gas drilling and service (8222)	967	(-27) – 29	244 – 247	218 – 276
Supervisors, petroleum, gas and chemical processing and utilities (9212)	163	(-16) – (-10)	51 – 51	35 – 41
Truck drivers (7411)	699	38 – 96	149 – 153	188 – 248
Welders (7265)	341	13 – 39	67 – 68	80 – 107
Other occupations	1,584	124 – 227	395 – 400	519 – 626

Rest of Canada Net Hiring Requirements to 2022

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
TOTAL	**12,166**	**252 – 1,052**	**2,671 – 2,719**	**2,924 – 3,771**
Chemical engineering technologists (2211)	57	1 – 5	11 – 11	12 – 17
Chemical engineers (2134)	57	6 – 9	11 – 11	17 – 21
Civil engineers (2131)	32	2 – 4	7 – 8	9 – 11
Crane operators (7371)	40	1 – 4	9 – 10	10 – 13
Drafting technologists and technicians (2253)	18	1 – 3	4 – 4	6 – 7
Drilling coordinators/production managers (0811)	380	22 – 59	112 – 115	134 – 174
Electrical/instrumentation engineers (2133)	21	2 – 4	5 – 5	7 – 9
Environmental technicians (4161)	20	1 – 2	4 – 4	5 – 6
Geologists and geophysicists (2113)	276	1 – 27	76 – 78	77 – 105
Heavy equipment operators (except crane) (7421)	246	12 – 31	52 – 53	64 – 83
Heavy-duty equipment mechanics (7312)	78	7 – 13	17 – 17	24 – 30
Industrial and manufacturing engineer (2141)	25	4 – 5	5 – 5	10 – 11
Industrial electricians (7242)	109	9 – 17	25 – 25	34 – 42
Industrial engineering and manufacturing technologists and technicians (2233)	16	1 – 2	5 – 5	5 – 7
Inspectors in public and environmental health and safety (2263)	80	1 – 7	22 – 22	23 – 29
Instrumentation engineering technologists (2241)	47	4 – 8	10 – 11	15 – 18
Instrumentation technicians (2243)	87	4 – 9	18 – 18	22 – 28
Insulators (7293)	36	2 – 4	8 – 8	9 – 12
Machinists and machining and tooling inspectors (7231)	55	2 – 5	12 – 12	13 – 17
Mechanical engineering technologists (2232)	21	2 – 4	4 – 4	7 – 8
Mechanical engineers (2132)	72	6 – 11	15 – 16	21 – 26
Millwrights (7311)	265	6 – 23	55 – 55	61 – 78
Mining engineers (2143)	2	0 – 0	0 – 0	1 – 1
Non-destructive testers and inspection technicians (2261)	33	3 – 5	8 – 8	11 – 13

2006 National Occupations Classification (NOC) Title	2012 Employment	Hiring to 2022 due to:		Net Hiring Requirements to 2022
		Industry Activity	Age-related Attrition	
		Low Growth – Expansion	*Low Growth – Expansion*	*Low Growth – Expansion*
Oil and gas drilling, servicing, and related labourers (8615)	808	9 – 62	85 – 89	94 – 150
Oil and gas well drillers, servicers, testers, and related workers (8232)	752	10 – 61	113 – 116	123 – 177
Oil and gas well drilling workers and service operators (8412)	562	2 – 38	74 – 76	76 – 114
Petroleum engineers (2145)	440	(-8) – 23	102 – 104	94 – 127
Petroleum, gas, chemical process operators (no steam-ticket required) (9232)	594	(-4) – 21	134 – 135	129 – 155
Petroleum/mining/ geological engineering technologists (2212)	168	5 – 20	39 – 40	43 – 60
Power engineers (steam-ticket required) (7351)	79	(-10) – (-7)	14 – 14	4 – 7
Production clerks (1473)	83	1 – 4	20 – 20	21 – 24
Purchasing agents and officers (1225)	117	3 – 13	30 – 31	33 – 45
Steamfitters and pipefitters (7252)	154	3 – 13	30 – 30	33 – 44
Supervisors, oil and gas drilling and service (8222)	611	(-10) – 26	155 – 157	146 – 183
Supervisors, petroleum, gas and chemical processing and utilities (9212)	100	(-8) – (-4)	32 – 32	24 – 28
Truck drivers (7411)	392	22 – 52	84 – 85	105 – 138
Welders (7265)	194	8 – 22	38 – 39	46 – 60
Other occupations	5,039	128 – 445	1,228 – 1,247	1,356 – 1,691

APPENDIX 6: LABOUR SHORTAGES

The following table summarizes "labour shortages" or the lack of workers from a quantitative perspective. It is important to recognize that even though there are indications that some occupations will have enough workers (quantitative balance), there may be gaps in the skills and experience the oil and gas industry is looking for. This is typically referred to as "skill shortages." **Shaded area indicates years with expected labour shortage for that occupation,** as unemployment rates fall below the balanced unemployment rate for the occupation.

Occupation	Balanced	Scenario	Unemployment Rate (%)									
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Chemical engineering technologists	3.5	Expansion	3.7	2.7	2.8	2.8	3.0	3.4	3.3	3.3	3.3	3.3
		Low	3.7	3.0	3.0	3.0	3.2	3.5	3.5	3.5	3.5	3.5
Chemical engineers	3.5	Expansion	3.0	2.7	2.8	2.7	3.0	3.2	3.0	2.9	3.0	3.0
		Low	3.0	2.9	2.9	2.8	3.2	3.3	3.3	3.3	3.3	3.3
Civil engineers	3.5	Expansion	3.7	2.7	2.8	2.8	3.0	3.4	3.3	3.3	3.4	3.3
		Low	3.7	3.0	3.0	3.0	3.2	3.6	3.5	3.5	3.5	3.5
Crane operators	5.5	Expansion	5.6	4.9	4.9	4.9	5.0	5.3	5.4	5.4	5.4	5.4
		Low	5.6	5.2	5.1	5.1	5.2	5.5	5.5	5.5	5.5	5.5
Drafting technologists and technicians	3.5	Expansion	3.2	2.5	2.6	2.6	2.9	3.1	3.0	3.0	3.1	3.1
		Low	3.2	2.8	2.8	2.8	3.1	3.3	3.4	3.4	3.4	3.3
Drilling coordinators/ production managers	3.5	Expansion	3.7	2.3	2.5	2.6	2.9	3.3	3.3	3.3	3.4	3.4
		Low	3.7	2.7	2.7	2.8	3.1	3.5	3.5	3.5	3.5	3.5
Electrical/instrumentation engineers	3.5	Expansion	2.6	2.6	2.7	2.6	2.9	3.0	2.8	2.7	2.8	2.9
		Low	2.6	2.8	2.8	2.7	3.1	3.2	3.2	3.3	3.3	3.2
Environmental technicians	3.5	Expansion	3.2	2.7	2.7	2.6	2.8	3.1	2.9	2.9	3.0	2.9
		Low	3.2	2.8	2.8	2.7	3.1	3.3	3.3	3.3	3.3	3.2
Geologists and geophysicists	3.5	Expansion	4.0	2.4	2.5	2.7	3.0	3.5	3.5	3.4	3.5	3.4
		Low	4.0	2.8	2.8	2.9	3.2	3.7	3.6	3.6	3.6	3.5
Heavy equipment operators	5.5	Expansion	4.8	4.9	5.0	4.9	5.0	5.0	4.9	5.0	5.1	5.2
		Low	4.8	5.1	5.1	5.0	5.2	5.4	5.5	5.5	5.5	5.5
Heavy-duty equipment mechanics	5.5	Expansion	4.7	4.8	4.9	4.8	5.0	5.0	4.9	5.0	5.0	5.1
		Low	4.7	5.0	5.0	4.9	5.2	5.4	5.4	5.4	5.5	5.4
Industrial electricians	6.5	Expansion	6.2	5.7	5.8	5.8	6.0	6.2	6.1	6.1	6.2	6.2
		Low	6.2	5.9	5.9	5.9	6.2	6.4	6.4	6.4	6.5	6.4
Industrial engineering and manufacturing technologists and technicians	3.5	Expansion	3.7	2.6	2.7	2.7	2.9	3.3	3.3	3.2	3.3	3.2
		Low	3.7	2.9	2.9	2.9	3.1	3.5	3.5	3.4	3.4	3.4
Inspectors in public and environmental health and safety	3.5	Expansion	3.6	2.7	2.7	2.8	3.0	3.3	3.3	3.2	3.3	3.3
		Low	3.6	3.0	2.9	2.9	3.1	3.4	3.5	3.4	3.5	3.4
Instrumentation engineering technologists	3.5	Expansion	3.4	2.7	2.7	2.7	2.9	3.2	3.2	3.2	3.2	3.2
		Low	3.4	2.9	2.9	2.9	3.1	3.3	3.4	3.4	3.4	3.4
Instrumentation technicians	3.5	Expansion	3.1	2.8	2.9	2.8	2.9	3.1	3.0	3.0	3.1	3.1
		Low	3.1	3.0	3.0	2.9	3.1	3.3	3.3	3.3	3.4	3.3
Insulators	6.5	Expansion	6.5	5.8	5.8	5.8	5.9	6.3	6.3	6.4	6.4	6.4
		Low	6.5	6.1	6.0	6.0	6.1	6.4	6.5	6.5	6.5	6.5
Mechanical engineering technologists	3.5	Expansion	2.9	2.7	2.7	2.6	2.8	3.0	2.9	2.9	3.0	3.0
		Low	2.9	2.8	2.8	2.7	3.1	3.2	3.3	3.3	3.3	3.3

Occupation	Balanced	Scenario	Unemployment Rate (%)									
			2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Mechanical engineers	3.5	Expansion	3.0	2.7	2.8	2.7	2.9	3.1	3.0	2.9	3.0	3.0
		Low	3.0	2.9	2.9	2.8	3.2	3.3	3.4	3.3	3.4	3.3
Millwrights and machinists	6.5	Expansion	6.5	6.0	6.0	5.9	6.0	6.3	6.4	6.4	6.4	6.4
		Low	6.5	6.2	6.1	6.1	6.2	6.4	6.5	6.5	6.5	6.5
Mining engineers	3.5	Expansion	2.2	3.0	3.1	2.9	3.1	2.9	2.7	2.8	2.8	3.0
		Low	2.2	3.0	3.2	3.0	3.3	3.5	3.6	3.6	3.6	3.6
Non-destructive testers and inspection technicians	3.5	Expansion	3.1	2.7	2.7	2.7	2.8	3.1	3.0	3.0	3.1	3.1
		Low	3.1	2.9	2.9	2.8	3.1	3.3	3.3	3.3	3.3	3.3
Oil and gas drilling, servicing, and related labourers	7.0	Expansion	7.1	6.5	6.4	6.4	6.5	6.8	6.9	6.9	7.0	6.9
		Low	7.1	6.7	6.6	6.6	6.6	6.9	7.0	7.0	7.0	7.0
Oil and gas well drillers, servicers, testers, and related workers	7.0	Expansion	7.1	6.4	6.4	6.4	6.5	6.8	6.9	6.9	7.0	6.9
		Low	7.1	6.7	6.6	6.6	6.6	6.9	7.0	7.0	7.0	7.0
Oil and gas well drilling workers and service operators	7.0	Expansion	7.1	6.5	6.4	6.4	6.5	6.8	6.9	6.9	7.0	7.0
		Low	7.1	6.7	6.6	6.6	6.6	6.9	7.0	7.0	7.0	7.0
Petroleum, gas, chemical process operator (No steam-ticket required)	5.5	Expansion	5.9	5.4	5.3	5.2	5.2	5.4	5.5	5.4	5.5	5.5
		Low	5.9	5.5	5.4	5.3	5.3	5.6	5.6	5.5	5.6	5.6
Petroleum/mining/ geological engineering technologists	3.5	Expansion	3.8	2.4	2.5	2.7	2.9	3.4	3.4	3.3	3.4	3.3
		Low	3.8	2.8	2.8	2.9	3.1	3.5	3.5	3.5	3.5	3.4
Petroleum engineers	3.5	Expansion	3.9	2.7	2.8	2.8	3.0	3.4	3.4	3.3	3.4	3.4
		Low	3.9	3.0	3.0	3.0	3.2	3.6	3.6	3.5	3.5	3.5
Power engineers (steam-ticket required)	5.5	Expansion	4.6	4.7	4.8	4.6	4.8	4.9	4.7	4.6	4.7	4.7
		Low	4.6	4.7	4.8	4.6	5.1	5.1	5.2	5.2	5.2	5.1
Production clerks	3.5	Expansion	3.9	3.6	3.5	3.2	3.2	3.4	3.5	3.4	3.5	3.5
		Low	3.9	3.7	3.5	3.4	3.3	3.5	3.6	3.5	3.6	3.5
Project engineers	3.5	Expansion	2.6	2.6	2.6	2.5	2.7	2.8	2.7	2.6	2.7	2.7
		Low	2.6	2.6	2.7	2.5	3.0	3.1	3.1	3.1	3.1	3.1
Purchasing agents and officers	3.5	Expansion	3.9	2.3	2.4	2.6	2.9	3.4	3.4	3.3	3.4	3.3
		Low	3.9	2.6	2.7	2.8	3.1	3.6	3.5	3.5	3.5	3.4
Steamfitters and pipefitters	6.5	Expansion	6.6	5.9	5.9	5.9	6.0	6.3	6.3	6.4	6.4	6.4
		Low	6.6	6.2	6.1	6.1	6.2	6.4	6.5	6.5	6.5	6.5
Supervisors, oil and gas drilling and service	3.5	Expansion	3.7	3.1	3.0	3.0	3.0	3.3	3.4	3.4	3.5	3.5
		Low	3.7	3.3	3.2	3.1	3.2	3.4	3.5	3.5	3.5	3.5
Supervisors, petroleum, gas and chemical processing and utilities	3.5	Expansion	4.0	3.5	3.4	3.2	3.3	3.5	3.5	3.5	3.6	3.6
		Low	4.0	3.6	3.5	3.4	3.3	3.6	3.6	3.6	3.6	3.6
Truck drivers	5.5	Expansion	5.5	4.7	4.7	4.8	4.9	5.3	5.3	5.4	5.4	5.4
		Low	5.5	5.0	4.9	5.0	5.1	5.4	5.5	5.5	5.5	5.5
Welders	6.5	Expansion	6.4	5.8	5.8	5.9	6.0	6.2	6.3	6.3	6.4	6.4
		Low	6.4	6.1	6.0	6.0	6.1	6.4	6.5	6.5	6.5	6.5
Other Occupations	6.0	Expansion	6.2	5.4	5.4	5.4	5.5	5.8	5.9	5.8	5.9	5.9
		Low	6.2	5.6	5.6	5.6	5.7	6.0	6.0	6.0	6.0	6.0

APPENDIX 7: GLOSSARY

Age-related attrition
Jobs vacated due to retirements and deaths.

Attraction
Activities based around the goal of attracting workers to a company, organization or industry.

Balanced labour market
Point at which the supply of workers meets labour market demand.

Bitumen
Tar-like form of crude oil, often found in oil sands deposits.

Conventional
Process of recovering petroleum from a well using standard drilling production methods.

Conventional exploration and production (E&P) sector
Activity for conventional and unconventional oil and gas reserves, excluding oil sands.

Downstream (sector)
Term commonly used to refer to the refining of crude oil, and the selling and distribution of natural gas and products derived from crude oil.

Hydraulic fracturing
Process of pumping fluid, sand and chemicals at a high pressure down a well hole to open a previously opened deposit vein to access more oil and gas.

Immigrant
Person who enters a country from another country. In this report, an immigrant refers to people who come to Canada on their own, rather than by the initiation of a company via international recruitment.

In situ
Technique using steam to recover oil from the sand in oil sands extraction.

Key job family
A series of related jobs distinguished by levels of knowledge, skills, abilities and other factors. e.g., field workers, operators, trades, technologists & technicians.

Labour market
Collective term describing the dynamics and interaction of workers and employers, including employment, unemployment, participation rates and wages.

Labour shortage
Labour supply is less than labour demand.

Labour supply
Availability of suitable workers in a labour market.

Labour surplus
Labour supply is greater than labour demand.

Liquefied natural gas (LNG)
Natural gas that undergoes a cooling process and converted to liquid for ease of storage and/or transportation.

Mid-career transitioner
Worker who changes their occupation and/or the industry they work for part-way through their working career.

Net hiring requirements
Sum of job openings created due to industry expansion plus age-related attrition.

Non-retirement employee turnover
Turnover due to employees moving within an industry or employees leaving the industry.

Offshore sector
Exploration for oil and/or natural gas located offshore, often in oceans or other large bodies of water. The offshore industry in Canada is mainly found in Newfoundland and Labrador and Nova Scotia.

Oil and gas services sector
Contracted exploration, extraction and production services to the E&P and oil sands sectors. This sector includes:

Drilling and completions services
Include drilling and service rigs activities

Geophysical services (also known as seismic)
Include survey, permitting and reclamation, line construction, drilling and data acquisition

Petroleum services
Include well services, oilfield construction and maintenance, production and transportation services

Oil sands sector
Sector of the petroleum industry involved in the extraction and upgrading of bitumen.

Open pit mine
An excavation or cut made at the surface of the ground for the purpose of extracting bitumen and remains open to the surface for the duration of the mine's life.

Petroleum industry
Global processes of exploration extraction, refining, transporting and marketing petroleum products.

Pipeline sector
Petroleum industry sector responsible for mainline transmission for transporting daily crude oil and natural gas production.

Retention
Activities based around keeping, or retaining, workers within a company, organization or industry.

Sector
Subset of an industry.

Shale
Fine-grained sedimentary rock from which liquid hydrocarbons can be extracted.

Steam-assisted gravity drainage (SAGD)
In situ method of producing heavy oil which involves two horizontal wellbores, one above the other. Steam is injected into the upper wellbore and softened bitumen is recovered from the lower wellbore.

Thermal oil recovery
The use of heat energy to enhance and facilitate the recovery of oil.

Total hiring outlook
Hiring required to fill job openings due to industry activity/expansion + age-related attrition + non-retirement turnover

Transferability
Ability for something to be transferred. In this report, this term refers to the ability to transfer skills from one occupation, sector or industry to another.

Unemployment rate
Percentage of the economically active population that are not working but want to work and are actively looking for employment.

Upgrading
Process by which heavy oil and bitumen are converted into lighter crude by increasing the ratio of hydrogen to carbon, normally using either coking or hydroprocessing.

Upstream petroleum industry
Includes searching for, recovering and producing crude oil and natural gas.

Workforce
Labour pool available in an industry and/or sector.

ENDNOTES

[1] LNG export assumptions used for the Expansion scenario are equivalent to export capacity of approximately 15 million tonnes per annum (MTPA).

[2] *The Decade Ahead: Strategic Human Resources Study* of the Upstream Petroleum Industry. Petroleum Human Resources Council of Canada. 2003.

[3] Data available on the Canadian Association of Petroleum Producers' (CAPP) website www.capp.ca

[4] Refer to Appendix 1 for an overview of the Petroleum HR Council's labour market modelling system and methodology.

[5] *Alberta Oil Sands Industry Quarterly Update*. Winter 2013

[6] During the Petroleum HR Council's most recent HR Trends and Insights Survey, drilling and service companies reported over 100 per cent turnover for some entry-level jobs. The impact of this kind of turnover will be explored further in the oil and gas services sector analysis section of this report.

[7] Unemployment rates are an indicator of how well the labour market is functioning. At six per cent unemployment, the Canadian labour market is considered close to the point where the supply of workers meets labour demand as it allows for the ebb and flow of workers leaving jobs and finding new ones. It also takes into account the structural issues that tend to occur within the labour market – especially after a recession – where there is a mismatch between the skills available in the labour market and those required by employers and/or the geographic gap between where the work is and where the workers are.

[8] Refer to Appendix 6 for each occupation's projected unemployment rate compared to that occupation's unemployment rate in a balanced labour market.

[9] A separate ***Oil Sands Labour Demand Outlook to 2022*** is available at www.petrohrsc.ca

[10] Research into employment impacts of oil and gas investment in the Low and Expansion Scenarios was conducted on behalf of the Petroleum HR Council by Prism Economics in March 2013, using Statistics Canada's 2008 Industry Input-Output model.

[11] LNG export assumptions used for the Expansion Scenario are equivalent to export capacity of approximately 15 million tonnes per annum (MTPA).

[12] *The Decade Ahead: Strategic Human Resources Study* of the Upstream Petroleum Industry. Petroleum Human Resources Council of Canada. 2003.

[13] While oil sands reserves exist in a number of other countries, only Canada has commercial production. Venezuela's extra heavy oil reserves are sometime referred to as oil sands. However, the viscosity of the Venezuelan deposits is not bituminous partially due to the proximity to the equator and warmer ground temperature. To date, Venezuela has used cold heavy oil production (CHOPS) to produce their extra heavy oil. Thermal production methods used in Canada's oil sands may increase Venezuela's production from extra heavy oil reserves.

[14] The National Occupational Classifications is the nationally accepted reference for occupations in Canada. www5.hrsdc.gc.ca/noc/english/noc/2006/AboutNOC.aspx

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The **Petroleum Human Resources Council of Canada** (now part of Enform Canada) is the primary resource to address workforce development and labour market issues in the Canadian petroleum industry. We provide innovative and strategic HR solutions to help the industry develop its workforce and proactively address labour challenges.

The Petroleum HR Council addresses issues by:

- Developing strategies, solutions, products and services to address industry's short, medium and long-term workforce issues
- Facilitating the exchange of ideas and information
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