Executive Summary

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Executive Summary

Canada’s oil and gas industry is emerging from two years of low oil prices and extensive reductions in spending and jobs with more efficient operations and a leaner and more productive workforce. With less volatile oil prices, rebounding rig counts and government approvals for pipelines and liquefied natural gas (LNG) projects, the industry welcomed 2017 with cautious optimism.

By the end of 2016, Canada’s oil and gas direct workforce was reduced to about 174,000 – 25% fewer jobs than 2014 peak levels. After losing an estimated 52,500 direct and thousands of indirect jobs over the past two years, 2017 will be a pivotal year for the industry. A number of factors over the coming months will determine whether oil prices rebound and remain above US$50 per barrel (/bbl) and a modest recovery is truly underway. Should oil prices stay below US$50 for the remainder of 2017, industry is expected to resume cost-cutting measures.

Due to current market uncertainty, the Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry report presents workforce projections for two scenarios, generated using PetroLMI’s labour forecasting model.

- **Modest Recovery**: oil price averages US$55/bbl in 2017 and increases to US$75 by 2020–2021. Natural gas is between C$2.70 and C$3.25 per gigajoule (/GJ). This results in increased industry spending and employment.
- **Delayed Recovery**: growth is delayed to 2018 as the average oil price averages US$46.50 in 2017 and increases only to US$60 by 2020–2021. Natural gas is between C$2.15 and C$2.55/GJ.

Whether Canada’s oil and gas industry experiences a modest or delayed recovery and expands or contracts its workforce in 2017 will influence the labour supply/demand dynamics for the duration of the forecast period.

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**Exploration and production capital and operating expenditures and industry employment, 2014 to 2021**

![Graph showing employment and expenditures from 2014 to 2021](image)

**Note**: PetroLMI’s forecasting model correlates workforce requirements to “employment drivers” including capital and operating spending within oil sands and non-oil sands (non-oil sands is also labelled as conventional E&P in this report) and oil sands production. These employment drivers differ by industry sector and by occupation. Workforce numbers have been rounded. Refer to scope and methodology and assumptions and scenario setting sections for more details.
Executive Summary

### Employment outlook to 2021

In a **Modest Recovery** scenario, the industry will require an additional 6,000 workers in 2017 and another 11,100 workers between 2018 and 2021. In total, the industry would create 17,100 net new jobs over the next five years and would experience a stable, average growth rate of 3 to 4% annually. In a **Delayed Recovery** scenario, a third year of low oil prices, would moderate total job gains with 6,700 net new jobs within the five-year forecast. In 2017, 8,700 jobs could be lost as low oil prices result in another round of cost and organizational restructuring. Although job recovery would be delayed by a year in this scenario, the growth rate is significantly higher with industry adding 15,400 new jobs between 2018 and 2021. These projections do not include jobs vacated by age-related attrition.

### Employment projections by sub-sector

Due to uncertainty regarding the sustainability of oil prices and industry investment, each industry sector is impacted differently over the duration of the forecast period. Neither oil and gas services nor conventional E&P are expected to return to 2014 employment levels regardless of which scenario unfolds. For the oil sands and pipelines sectors job growth is expected starting in 2017, with both sectors surpassing 2014 levels by 2021.

#### Oil and gas services:

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>81,500</td>
<td>(27,900 jobs lost since 2014)</td>
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</tr>
<tr>
<td></td>
<td>6,700 (+8%)</td>
<td>5,500 (+10%)</td>
</tr>
<tr>
<td></td>
<td>-600 (-1%)</td>
<td>2,600 (+5%)</td>
</tr>
</tbody>
</table>

2017 will be a challenging year regardless of the scenario. In a Modest Recovery, increases in activity levels may have companies scrambling to find field workers. In a Delayed Recovery, the sector is anticipated to significantly shed jobs in 2017 due to continued restructuring. Although job growth begins in 2018 and is accompanied by labour shortages, the overall employment change from 2016 to 2021 is -1%.

#### Conventional E&P:

<table>
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<tbody>
<tr>
<td>53,800</td>
<td>(21,600 jobs lost since 2014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5,500 (+10%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2,600 (+5%)</td>
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</tr>
</tbody>
</table>

Despite adding jobs starting in 2017 in a Modest Recovery and in 2018 for a Delayed Recovery scenario, companies are unlikely to add full-time employees until there is greater confidence that prices and investment are stable. Since E&P occupations do not transfer as easily into other industries, it is anticipated that labour supply will be readily available.

#### Oil sands:

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>28,900</td>
<td>(2,400 jobs lost since 2014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4,000 (+14%)</td>
<td></td>
</tr>
</tbody>
</table>

Job losses within capital-driven roles in 2017 will be offset by new operations roles as major projects currently under construction are completed and move into production. The sector’s focus on operational reliability and efficiency will drive occupational demand between 2018 and 2021.

#### Pipelines:

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>9,700</td>
<td>(600 jobs lost since 2014)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,000 (+10%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>800 (+8%)</td>
<td></td>
</tr>
</tbody>
</table>

Growth in natural gas production is the key differentiator in pipeline employment demand. Implementation of the latest technology, including more automation and further efficiency and productivity gains, could reduce workers requirements further.

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**Note:** While two scenarios are provided for total industry, oil and gas services, conventional E&P and pipelines, the oil sands sector has one scenario due to only a single set of assumptions for oil sands spending and production. Forecasted oil production does not take into account any pipeline capacity constraints during the five-year period. Natural gas production in the Modest Recovery assumes higher production levels from Western Canada due to additional pipeline capacity.
Age-related attrition

If assumptions regarding retirement rates hold steady, approximately 4,000 direct oil and gas employees may retire in 2017 and approximately 22,000 to 23,000 within the five-year forecast.

Although companies express concern about the loss of experience resulting from two years of workforce reductions, the continued focus on cost containment suggests not all job vacancies resulting from age-related attrition will be filled going forward. Further restructuring may result in the elimination of some of these roles. The implementation of technology, such as automation and digitization, could also reduce the need to fill some vacant positions. Companies surveyed in early February noted that replacing retired workers will depend on the position, type of work involved and availability of other options to accomplish the work. As a result, age-related attrition is not factored into the overall labour demand projections in this report.

Labour supply/demand gaps

The moderate increase in activity levels experienced in the first quarter of 2017 has already created labour shortages for some occupations. As activity levels continue to rise, labour supply/demand gaps will become more widespread particularly in 2018 and 2019 due to two factors:

• The addition of jobs for a number of occupations at a pace greater than the industry average.
• The shrinkage of the labour force due to fewer new workers seeking employment in the industry, and experienced workers leaving for other industries.

In a Modest Recovery scenario, hiring difficulties for some occupations begin in 2017 and continue for the duration of the forecast period. In a Delayed Recovery scenario, shortages do not occur until 2018; however, they are more acute as even more workers seek employment elsewhere with layoffs continuing for a third consecutive year. The table below highlights the occupations that will have a higher growth rate than industry average and are forecasted to encounter a labour shortage.

<table>
<thead>
<tr>
<th>Occupations projected to experience hiring challenges in 2017 (Modest Recovery):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Geological, petroleum and mining technologists</td>
</tr>
<tr>
<td>• Industrial electricians</td>
</tr>
<tr>
<td>• Inspectors in public and environmental health and safety</td>
</tr>
<tr>
<td>• Managers in natural resources production, drilling and well servicing</td>
</tr>
<tr>
<td>• Oil and gas drilling, servicing and related labourers</td>
</tr>
<tr>
<td>• Oil and gas well drillers, servicers, testers and related workers</td>
</tr>
<tr>
<td>• Oil and gas well drilling workers and service operators</td>
</tr>
<tr>
<td>• Purchasing agents and officers, including landmen</td>
</tr>
<tr>
<td>• Purchasing managers</td>
</tr>
<tr>
<td>• Supervisors and contractors, oil and gas drilling and services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupations projected to undergo hiring challenges in 2018–2019, both scenarios:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Civil engineers</td>
</tr>
<tr>
<td>• Geologists and geophysicists</td>
</tr>
<tr>
<td>• Heavy equipment operators</td>
</tr>
<tr>
<td>• Heavy-duty equipment mechanics</td>
</tr>
<tr>
<td>• Industrial and manufacturing engineers</td>
</tr>
<tr>
<td>• Instrumentation technicians</td>
</tr>
<tr>
<td>• Natural and applied science policy researchers, consultants and program officers</td>
</tr>
<tr>
<td>• Petroleum engineers</td>
</tr>
<tr>
<td>• Power engineers and power systems operators</td>
</tr>
<tr>
<td>• Professional occupations in advertising, marketing and public relations</td>
</tr>
</tbody>
</table>

Note: In the Delayed Recovery scenario, the same occupations listed on the left are projected to undergo hiring challenges beginning in 2018.

Conclusion

Some recovery is projected for Canada’s oil and gas industry in the next five years with 6,700 to 17,100 net new jobs created depending on whether a recovery begins in 2017 or 2018. In addition, a portion of the 22,000 to 23,000 job vacancies that are expected due to age-related attrition will contribute to increased hiring activity.

Regardless of whether the industry experiences a Modest or Delayed Recovery, job creation is projected to plateau in 2020 – 2021 due to productivity improvements and industry’s limitations to be able to compete in the global energy market – at least within the five-year forecast.

In order to sustain growth beyond 2021, market diversification is required. The United States, traditionally Canada’s primary consumer, has fast emerged as a key competitor – for both market share and industry investments. Maintaining a lean and productive workforce, as well as operational efficiencies through innovation and technology, will be key to remaining competitive. Canada’s industry will also need to focus on effectively managing the labour and skill shortages that have impacted costs and productivity in the past.

At the same time the oil and gas workforce will play a key role in industry’s ability to compete globally. Their technical skills and knowledge will lead to further innovation and the development of technology to facilitate the industry’s transition to a global energy supplier while adapting to widening competitive pressures and new carbon regulations.
Introduction

It has been a grueling two years for Canada’s oil and gas industry. In response to the steep decline in oil prices that began in late 2014, the exploration and production (E&P) sector reduced its capital spending in 2015 to roughly half of 2014 levels. As oil prices dipped below US$30 per barrel in early 2016, the industry entered a second year of reduced investments.

Companies across the industry also undertook deep cuts to expenses and sought out cost-saving measures in their product lines, assets, workforces, organizational structures and processes. The Fort McMurray wildfires in May 2016 added to the industry’s woes by forcing the shut in of many oil sands operations, interrupting an estimated $1 billion of production, while also curtailing the work of service and pipeline operators.

Job losses and continued uncertainty

In alignment with PetroLMI’s Lower scenario projections in its April 2016 Labour Market Outlook 2016 to 2020 for Canada’s Oil and Gas Industry report, approximately 52,500 direct oil and gas jobs were lost in 2015 and 2016, along with thousands of indirect jobs in oil and gas-related construction, manufacturing, transportation and other technical and business sectors. As a result, the oil and gas industry entered 2017 with an estimated employment of 174,000 direct workers, a 25% reduction from the 2014 peak employment level of over 226,500 workers.

Cost restructurings of the past two years resulted in many companies positioning themselves to be profitable at US$50–$55 per barrel (/bbl) of oil. With a less volatile oil price, rebounding rig counts and government approvals for the development of pipelines and liquefied natural gas (LNG) projects, the industry welcomed 2017 with cautious optimism. The industry had repositioned itself to operate in a lower oil price environment. At the same time, however, some market uncertainties remain including infrastructure challenges for Canada’s oil and gas industry to compete in the global energy market.

With that, the extent of employment growth for the industry over the next year also remains less certain. This year’s report, Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry, therefore, considers two potential scenarios based on favourable and less favourable pricing and market conditions and takes into consideration the competitive factors that continue to affect industry activity.

The report provides workforce projections to 2021, including employment projections and corresponding job growth, potential hiring activity resulting from age-related attrition¹ and labour supply opportunities and challenges. Demand and supply forecasts are provided for the total industry as well as by key occupation. Demand projections are also available by sub-sector and are presented in a separate section. Lastly, the impact of oil and gas activity on indirect jobs across Canada is also detailed in the report.

PetroLMI’s labour market outlooks are intended to provide information to the oil and gas industry, education and training institutions, and governments to assist with workforce planning, program and policy development. The projections are based on spending and production assumptions at the time of research.

“To be sure, the industry will continue to endure, ‘up and down and over and out’ in 2017 and beyond. Environmental regulations, cross-border tax differentials, market access, geopolitics, and alternative energy systems are a few of the many challenges facing the industry.”

Peter Tertzakian, Executive Director, ARC Energy Research Institute

¹Oil and gas companies surveyed do not plan on filling 100% of the job vacancies resulting from workforce retirements. Therefore, unlike previous PetroLMI outlooks, this report does not present Net Hiring Requirements (i.e., hiring due to industry expansion plus age-related attrition).
Scope and methodology

PetroLMI’s labour market projections are produced using a modelling system developed in 2006 and continuously refined in consultation with industry, labour market economists and workforce planning analysts.

The model produces labour demand projections for the upstream and midstream oil and gas industry (i.e., yearly employment, expansion and replacement demand) by sector and by occupation. The model also projects potential labour supply and unemployment rates for the total industry and by occupation to help identify labour supply/demand gaps and opportunities.

- **Employment**: number of direct workers required to support industry production and spending levels.
- **Expansion demand**: also referred to as employment (or job) growth or contraction, is the change in employment levels or new jobs created or lost between two periods plus adjustments.
- **Replacement demand**: also defined as age-related attrition, denotes the number of jobs vacated due to retirements and natural deaths among the oil and gas labour force.
- **Labour supply/demand gap**: comparison of industry’s potential labour supply against its labour demand to determine whether industry will experience a labour surplus or shortage. Measured in terms of projected unemployment rate relative to the balanced unemployment rate.

In-scope occupations

The model is able to produce labour market projections for 48 occupations considered core to Canada’s upstream and midstream sectors, which account for 65% of the industry’s current workforce. The occupations have been mapped to the National Occupational Classification (NOC) 2011 version.

An “other occupations” category captures the residual workforce (remaining 35%) and is the sum of all other occupations directly employed within industry. This methodology ensures the total industry workforce is captured within the forecast and also enables PetroLMI to provide occupational projections and analysis. Refer to Appendix 1 for sample job titles within the 48 and “other” occupations detailed in the model.

Employment and expansion demand

To project employment, the model starts with baseline employment numbers derived from Statistics Canada and/or direct industry surveys then uses ‘employment drivers’ to identify the required workforce levels to support the level of industry activity (i.e., spending and/or production) in a given year. The model does this by sector and occupation with some adjustments for labour productivity and other factors.

### Table 1: Employment Drivers

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Conventional E&amp;P CAPEX</th>
<th>Conventional E&amp;P OPEX</th>
<th>Oil sands CAPEX</th>
<th>Oil sands OPEX</th>
<th>Oil sands production</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Oil and gas services</strong>: contracted exploration, extraction and production services to the oil sands and non-oil sands E&amp;P sectors and includes the following sub-sectors:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>• Drilling and completion services, including drilling and service rig activities</td>
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<td></td>
</tr>
<tr>
<td>• Geophysical services (also known as seismic) including survey, permitting and reclamation, line construction and data acquisition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Petroleum services pertain to oilfield services including, but not limited to, acidizing wells, cementing and perforating well casings, well testing and servicing, pumping, and oil well logging.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Conventional E&amp;P</strong>: exploration and production of oil and gas for onshore and offshore conventional and unconventional reserves except oil sands.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Oil sands</strong>: involves the extraction, production and upgrading of bitumen specifically within mining, in situ and upgrading operations.</td>
<td></td>
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</tr>
<tr>
<td><strong>Pipelines</strong>: storage and mainline transmission of oil and gas.</td>
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</tbody>
</table>

Table 1 Notes:

CAPEX = capital expenditures; OPEX = operating expenditures, both adjusted to take out inflation which does not create jobs.

Oil sands production forecast was sourced from the Canadian Association of Petroleum Producers’ Crude Oil Production Forecast released June 23, 2016 and adjusted to disregard the production drop resulting from the Fort McMurray wildfires since the temporary shut-ins did not directly result in permanent operations layoffs.

Sectors considered out-of-scope: downstream, LNG construction and operations, construction including engineering, manufacturing, truck transportation, professional, technical and scientific services, financial, etc.

1 For the purpose of this report, total industry and sub-sector workforce numbers are rounded to the nearest hundreds except for pipelines which are for the most part rounded to the nearest 10 or 50 as appropriate (due to smaller numbers). Occupational projections are rounded to the nearest five with some exceptions as noted in the report. Accordingly, numbers may not add up.
The following table outlines the key differences between the scenarios from 2017 to 2021:

### Modest Recovery:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Favourable commodity prices</strong></td>
<td>encourage a 40% increase in capital investment in the conventional E&amp;P sector in 2017 and a 52% increase overall to 2021.</td>
</tr>
<tr>
<td><strong>Oil</strong></td>
<td>Oil price averages US$55/bbl in 2017 and increases to $75 by 2020–21.</td>
</tr>
<tr>
<td></td>
<td>Oil supply/demand balance is achieved in 2017 as material cuts to global production occur within OPEC and non-OPEC countries.</td>
</tr>
<tr>
<td><strong>Natural gas</strong></td>
<td>Average annual AECO Price is between C$2.70 to $3.25/GJ.</td>
</tr>
<tr>
<td></td>
<td>Natural gas demand grows as Canada maintains its current markets and sees growth in industrial demand. Also assumes higher production levels from Western Canada due to additional pipeline capacity.</td>
</tr>
</tbody>
</table>

### Delayed Recovery:

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capital investment</strong></td>
<td>Capital investment in the conventional E&amp;P sector declines another 1% in 2017 due to lower commodity prices but increases overall by 25% to 2021.</td>
</tr>
<tr>
<td><strong>Oil</strong></td>
<td>Average oil price averages US$46.50/bbl in 2017 but increases to $60 for 2020–21.</td>
</tr>
<tr>
<td></td>
<td>Global oil market continues to be oversupplied in 2017 as target production cuts are not met but market conditions improve in 2018.</td>
</tr>
<tr>
<td><strong>Natural gas</strong></td>
<td>Average annual AECO Price is between C$2.15 to $2.55/GJ.</td>
</tr>
<tr>
<td></td>
<td>Natural gas output is relatively flat to 2021 with slower demand from current markets offset by increased industrial demand.</td>
</tr>
</tbody>
</table>

Notes:
- Oil price in US$/bbl WTI; Natural gas price in C$ per gigajoules, AECO Hub Price Index.
- Sources: Pricing and expenditure forecasts supplied by ARC Energy Research Institute as of January 10, 2017 which incorporates the production outlook from the Canadian Association of Petroleum Producers’ June 2016 Crude Oil Forecast, Markets and Transportation report.
- PetroLMI conducted industry consultations in December 2016 and January 2017 to confirm the two scenarios, assumptions and resulting labour demand projections and analysis.
Both scenarios share the following projections for the forecast period from 2017 to 2021:

- **Conventional E&P**: operational spending remains relatively flat from 2016 to 2021. Sector spending does not reach 2014 levels within the forecast period.
- **Natural gas**: growth in investment and production is required to support the transition from coal-fired electricity generation, as well as increased industrial usage, particularly in the oil sands. A small LNG plant\(^1\) is expected to be operational before the end of the forecast period, however, it does not drive increased natural gas production beyond current supplies.

### 2017 – A PIVOTAL YEAR FOR CANADA’S OIL AND GAS INDUSTRY

In the first quarter of 2017, oil prices were trending around US$50/bbl, prompting increased levels of industry spending and activity. Whether this trend continues or swings downward in the months ahead, it positions 2017 as a pivotal year for Canada’s oil and gas industry.

There are a number of factors at play. The Organization of the Petroleum Exporting Countries’ (OPEC) cuts in oil production was the main driver behind the oil price increases. Achieving an average annual oil price well above US$50/bbl in 2017 will depend on how the world’s oil producers address the supply imbalances that began in 2014. As the price increases, producers from all jurisdictions will likely look to generate more revenues by increasing production.

If an oversupply of oil is re-established in 2017 driving oil prices to average well below US$50/bbl, further delay in Canada’s oil and gas industry recovery is expected. A third year of lower oil prices would stall investment and production growth until demand outpaces supply. Oil prices would start increasing in 2018.

Regardless of which direction oil prices are headed, continued productivity and efficiency improvements will be essential for industry profitability and could impact investment. The industry is transitioning due to carbon regulation. Market diversification remains critical to Canada’s ability to compete and while government approvals on potential pipeline and LNG projects are encouraging, final investment decisions have not yet been made on these large, game-changing projects. All of this will impact the industry’s hiring needs and challenges to 2021.

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\(^1\)The workforce required to construct and operate a small LNG (liquefied natural gas) facility is not included in PetroLMI’s workforce projections. Refer to Exploring LNG in Canada report, published in April 2016 for LNG-specific workforce requirements.
Industry-wide Labour Market Outlook to 2021

Job cuts in 2015 and 2016 resulted in improved operational efficiency and increased workforce productivity.

The two scenarios presented in this report reflect the current market uncertainty for the Canadian oil and gas industry and as a result show diverging employment projections. If the Delayed Recovery scenario plays out, a third year of decline in industry investment is expected to result in further job cuts in 2017 followed by job gains in 2018. This scenario results in significantly less employment growth overall than anticipated in the Modest Recovery scenario, which reflects job gains beginning in 2017. Regardless of which scenario unfolds, however, overall growth in industry employment is not expected to fully recover or return to 2014 levels within the forecast period.

Both scenario projections presented in this report trend below last year’s Labour Market Outlook 2016 to 2020’s Lower scenario (published in April 2016 and illustrated in the graph below), in part, due to a reset by industry on the level of productivity and lower forecasted spending. Companies are expected to continue to look for ways to create efficiencies, further improve productivity and make concerted efforts to maintain leaner workforces.

In the graph below, a slight decrease in employment during the latter portion of the forecast period in both scenarios is due to assumptions that:

- Labour productivity improvements will continue through to 2021; and,
- Companies will be hesitant to invest in additional production increases due to uncertainty in accessing new markets.

If the industry is able to sustain profitability through effective cost management and has greater access to markets within and beyond North America, the employment demand could increase from what is currently projected in the forecast period.

Oil and gas direct employment, 2014 to 2021

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- Labour productivity improvements will continue through to 2021; and,
- Companies will be hesitant to invest in additional production increases due to uncertainty in accessing new markets.

If the industry is able to sustain profitability through effective cost management and has greater access to markets within and beyond North America, the employment demand could increase from what is currently projected in the forecast period.
Expansion demand dependent on what happens in 2017

Whether the oil and gas industry’s employment increases or declines in 2017, it will directly influence the labour supply/demand dynamics for the duration of the forecast period. These dynamics present a key planning consideration for workforce and career planners, job seekers and trainers. The following chart provides a summary of the estimated expansion demand to 2021 in both scenarios.

Oil and gas expansion demand summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Modest Recovery</td>
<td>-8,700 (-5%)</td>
<td>6,000 (+4%)</td>
<td>11,100 (+6%)</td>
<td>17,100 (+10%)</td>
</tr>
<tr>
<td>Delayed Recovery</td>
<td>-8,700 (-5%)</td>
<td>6,700 (+4%)</td>
<td>15,400 (+9%)</td>
<td>22,100 (+12%)</td>
</tr>
</tbody>
</table>

Figure 5  Source: PetroLMI

Modest Recovery scenario

In the Modest Recovery scenario, it is projected that a large proportion of new jobs will be added in the early years of the forecast period.

If oil prices continue to increase through 2017 and investment is encouraged, the industry will require about 6,000 additional workers in the year. It is anticipated that companies will implement a variety of talent strategies to address their hiring needs1, while simultaneously mitigating risks related to cost and productivity, including:

- Recalling experienced workers
- Enhancing employee engagement and productivity
- Developing existing staff to take on additional responsibilities and/or new positions
- Using a flexible workforce that can ramp up and down as required and address peak activity levels
- Contracting workers until there is greater confidence that higher levels of industry activity can be sustained.

In this scenario, employment growth will continue from 2018 to 2021 and the industry would gain an additional 11,100 (+6%) new jobs. This results in a total employment gain of 17,100 new jobs between 2017 and 2021 and a stable annual growth rate of 3–4%, plateauing in 2020–2021.

Occupations with greatest job gains in 2017 (Modest Recovery scenario):

1. Supervisors and contractors, oil and gas drilling and services
2. Oil and gas well drillers, servicers, testers and related workers
3. Oil and gas well drilling workers and service operators
4. Oil and gas drilling, servicing and related labourers
5. Purchasing agents and officers, including landmen
6. Managers in natural resources production, drilling and well servicing
7. Heavy equipment operators (except crane)
8. Power engineers and power systems operators
9. Geologists and geophysicists
10. Geological, petroleum and mining technologists

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1. 2017 Industry HR Trends of 36 oil and gas companies representing close to 80,000 direct workers in Canada.
Delayed Recovery scenario

In a Delayed Recovery scenario, job growth would not commence until 2018. But when it does, it will occur at a higher rate than in the Modest Recovery scenario.

A third year of oil prices averaging well below US$50 is likely to result in another round of restructuring through divestitures, mergers and acquisitions and dissolutions. In this scenario, an additional 8,700 jobs could be lost in 2017. After three years of job cuts and workers seeking employment elsewhere or pursuing other opportunities it is expected there will be a smaller pool of available labour to hire from when activity picks up.

In this scenario it is assumed that oil supply/demand balance will be achieved in 2018, and the industry will restore investment and activity to meet demand. As production output increases, employment demand will also grow between 2018 and 2021, with 15,400 new jobs created. While a prolonged downturn would moderate overall job gains of 6,700 during the forecast period, the pace of growth from 2017 to 2018 would be about 7% – almost double the growth rate projected in the Modest Recovery scenario. Companies will not only need to hire for some occupations more quickly, they will also need to hire them in greater numbers.

Occupations with greatest job losses in 2017 (Delayed Recovery scenario):

1. Oil and gas well drillers, servicers, testers and related workers
2. Supervisors and contractors, oil and gas drilling and services
3. Managers in natural resources production, drilling and well servicing
4. Truck drivers
5. Petroleum engineers
6. Oil and gas well drilling workers and service operators
7. Geologists and geophysicists
8. Oil and gas drilling, servicing and related labourers
9. Purchasing agents and officers including landmen
10. Millwrights

Top 10 occupations with greatest expansion demand from 2017 to 2021, in both scenarios

<table>
<thead>
<tr>
<th>Occupation (NOC 2011)</th>
<th>2016 Estimated Employment</th>
<th>Scenario</th>
<th>Expansion Demand (% growth/decline)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2017</td>
</tr>
<tr>
<td>Total industry</td>
<td>173,900</td>
<td>Modest</td>
<td>6,000 [+4%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-8,700 [-5%]</td>
</tr>
<tr>
<td>Supervisors and contractors, oil and gas drilling and services (8222)</td>
<td>7,940</td>
<td>Modest</td>
<td>860 [+11%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-450 [-6%]</td>
</tr>
<tr>
<td>Oil and gas well drillers, servicers, testers and related workers (8232)</td>
<td>10,600</td>
<td>Modest</td>
<td>825 [+8%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-475 [-4%]</td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) (7521)</td>
<td>8,565</td>
<td>Modest</td>
<td>225 [+3%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-120 [-1%]</td>
</tr>
<tr>
<td>Power engineers and power systems operators (9241)</td>
<td>6,735</td>
<td>Modest</td>
<td>175 [+3%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>75 [+1%]</td>
</tr>
<tr>
<td>Oil and gas well drilling workers and service operators (8412)</td>
<td>4,690</td>
<td>Modest</td>
<td>480 [+10%]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-250 [-5%]</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---------------------------</td>
<td>----------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Purchasing agents and officers including landmen [1225]</td>
<td>3,290</td>
<td>Modest</td>
<td>295 (+9%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-215 (-7%)</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing [0811]</td>
<td>5,075</td>
<td>Modest</td>
<td>260 (+5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-410 (-8%)</td>
</tr>
<tr>
<td>Oil and gas drilling, servicing and related labourers [8615]</td>
<td>5,390</td>
<td>Modest</td>
<td>365 (+7%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-220 (-4%)</td>
</tr>
<tr>
<td>Geologists and geophysicists [2113]</td>
<td>3,550</td>
<td>Modest</td>
<td>160 (+4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-245 (-7%)</td>
</tr>
<tr>
<td>Heavy-duty equipment mechanics [7312]</td>
<td>2,860</td>
<td>Modest</td>
<td>70 (+3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-80 (-3%)</td>
</tr>
<tr>
<td>Petroleum engineers [2145]</td>
<td>3,970</td>
<td>Modest</td>
<td>90 (+2%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-255 (-6%)</td>
</tr>
</tbody>
</table>

Table 2. Source: PetroLMI

Notes: The top 10 occupations represent 36% of industry’s workforce in 2016 and almost 50% of total expansion demand in the Modest Recovery scenario. Numbers may not add up due to rounding. Refer to Appendix 2 for the detailed list of occupational projections for the industry.

Age-related attrition impacted differently by two years of employment cuts

PetroLMI’s model projects that about 22,000 to 23,000 direct oil and gas workers may retire between 2017 and 2021 if historical retirement rates and workforce demographics remain steady. In 2017 alone, the industry could experience over 4,000 retirements.

Retirement eligibility is relatively similar regardless of which scenario; however, the rate and timing of replacing retirees is expected to differ. Replacement would commence in 2017 and continue for the duration of the forecast period in the Modest Recovery while in the Delayed Recovery scenario, it is assumed the majority of the positions vacated by retirees in 2017 would be absorbed as the industry looks to survive a third year of low oil prices.

In previous PetroLMI outlooks when the industry was anticipating rapid growth, it was assumed that positions vacated by retirements would be filled and add to industry’s hiring requirements. However, in the current climate this is not the case. In 2015 and 2016, many of the positions vacated by retirements were not filled as part of company strategy to reduce costs and create a leaner workforce. In a survey of oil and gas companies in early February 2017, companies indicated that any decision to fill a job vacancy due to a retirement would be assessed based on the position, type of work involved and availability of other options to accomplish the work. Some of these companies expressed concerns about the loss of experience resulting from two years of workforce reductions and a further loss of experience due to age-related attrition and that could be a consideration in deciding whether to replace a retiring worker.

Age-related attrition impacted differently by two years of employment cuts

Individual company consultations provided some insights into strategies to address retirements at an occupational level:

- **Supervisors and managers:** Over one-quarter of the positions that could be potentially impacted by age-related attrition during the forecast period are at the supervisory or managerial level. Companies indicated that if it is necessary to fill these positions, internal succession planning will play a key role. Further restructuring to maintain a lean organization may result in the elimination of some of these positions.

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1. 2017 HR Trends and Insights: survey of 36 oil and gas companies representing close to 80,000 direct workers.
2. As a result and with the exception of the labour demand tables in the appendices, age-related attrition is not combined with expansion demand to present a net hiring requirement for the industry.
- **Operators:** About one-third of the positions impacted would be operators, including drillers, oil and gas services operators, and field, plant and pipeline operators. Since these positions tend to be directly related to a company’s profitability, employers said they will carefully consider whether to fill the role or transfer the duties and responsibilities to other positions. The implementation of technology, such as automation and digitization, could decrease the need to backfill some of these positions.

- **Engineers:** Engineering roles are a relatively small percentage of the industry’s overall age-related attrition projections. However, many engineers provide industry-specific technical knowledge and skills. Companies looking to implement innovation and efficiencies will closely monitor the impact any further loss of experienced engineers will have on productivity. This may drive some replacement of retiring engineers.

- **Trades:** Trade vacancies will also be carefully assessed due to their importance in maintaining and optimizing oil and gas operations. Companies may transfer duties and responsibilities to other positions when possible. The implementation of technology, such as automation and digitization, could reduce the need to fill some vacant positions.

Positions vacated within occupations from other job categories or groups will be considered on a case-by-case basis. The chart below illustrates year-over-year age-related attrition during the forecast period, broken down by occupational group.

### Summary of potential age-related attrition by year and by occupational grouping in Modest Recovery scenario*

![Chart showing job vacancies by year and occupational group](chart)

**Notes:**
* Based on core occupations included in PetroLMI’s labour modeling system plus “other occupations” category, which is comprised of a number of occupations belonging to the different occupational groupings.
** Includes occupations such as supply chain, inspectors, environment, health & safety professionals, marketing and public relations.
*** Includes occupations such as drillers, well servicing, field, plant and pipeline operators.

Refer to Appendix 2 for projected age-related attrition by occupation.

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**Labour supply/demand gaps expected within the forecast period**

Labour surpluses are expected to continue for the majority of oil and gas occupations throughout 2017. As projected in the industry-wide outlook report released in April 2016, however, the modest increase in activity levels experienced in the first quarter of 2017 has already created labour shortages for certain occupations. As activity levels intensify and growth is sustained year-over-year, labour gaps could deepen and become more widespread.

In the **Modest Recovery** scenario, hiring difficulties for some occupations begin in 2017 and continue for the duration of the forecast period. Labour shortages are not projected in the **Delayed Recovery** scenario until 2018, but the shortage could be more acute as the industry’s labour force further shrinks as another year of workforce reductions forces displaced workers and potential new entrants to seek employment in other industries. In both scenarios, the industry’s unemployment rate is projected to fall below 2014 levels for the duration of the forecast period.
**Attracting workers may prove difficult**

The magnitude of the layoffs in the oil and gas and related industries in the last two years has impacted the industry’s ability to attract workers. Job seekers turned to industries perceived to have more employment stability. In addition, the attraction and retention strategies previously used, such as above-average compensation and benefits packages, have changed significantly due to cost-cutting measures.

Going forward, the oil and gas industry is at risk of experiencing attraction and retention issues for certain occupations due to a combination of: the addition of jobs for these occupations at a pace greater than the industry average and labour shortages.

In the **Modest Recovery** scenario, the labour supply/demand gaps begin almost immediately due to the 40% increase in capital spending projected for 2017 and significant growth for the occupations that saw higher numbers of workers leaving the workforce in 2015 and 2016.

In the **Delayed Recovery**, labour market tightness is expected to return for the majority of the industry’s occupations in 2018. Steeper growth in activity levels and employment will occur, as the industry ramps up to address depleting oil and gas supplies.

“With the unemployment rates where they are now [and] with the downsizing that went on in our business, we anticipated that there would be a number of people champing at the bit to get back to work. [But] we’re finding that there’s not as big an appetite for a lot of those people to come back to the oil patch ... which is unfortunate.”

Rob Cox, Vice President of Canadian Operations, Trican Well Service
The following table identifies those occupations that are projected to experience hiring challenges due to the combination of a greater than average employment growth rate and/or a tight labour market, particularly in 2018 and 2019, in both scenarios.

<table>
<thead>
<tr>
<th>Occupation (NOC)</th>
<th>2017 in Modest Recovery scenario*</th>
<th>2018–2019 Both scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Above average growth</strong></td>
<td><strong>Labour shortage</strong></td>
</tr>
<tr>
<td>Civil engineers (2131)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Engineering managers (0211)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facility operation and maintenance managers (0714)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geological, petroleum and mining technologists (2212)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Geologists and geophysicists (2113)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) (7521)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Heavy-duty equipment mechanics (7312)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial electricians (7242)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Inspectors in public and environmental health and safety (2263)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Instrumentation technicians (2243)</td>
<td></td>
<td>•</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing (0811)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Natural and applied science policy researchers, consultants and program officers (4161)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and gas drilling, servicing and related labourers (8615)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Oil and gas well drillers, servicers, testers and related workers (8232)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Oil and gas well drilling workers and service operators (8412)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Petroleum engineers (2145)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power engineers and power systems operators (9241)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Professional occupations in advertising, marketing and public relations (1123)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Industrial and manufacturing engineers (2141)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchasing agents and officers including landmen (1225)</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Purchasing managers (0113)</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td>Supervisors and contractors, oil and gas drilling and services (8222)</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

Table 3  Source: PetroLMI
*Also in 2018 for the Delayed Recovery scenario. Refer to Appendix 7 for projected unemployment rates by occupation.
Oil and Gas Sub-Sector Analysis

Oil and gas employment losses during 2015 and 2016 were deep and extended to indirect jobs including construction, manufacturing, transportation and professional consulting positions. Overall, in terms of direct employment, the oil and gas services sector experienced the greatest number of job losses, while the conventional E&P sector experienced the greatest percentage decline in employment. Oil sands operations realized job losses for the first time in their history. The pipelines sector, meanwhile, which had ramped up employment in anticipation of major infrastructure expansions, also reduced their workforces as projects were delayed.

Due to the current uncertain market conditions, projections for the oil and gas services and the conventional E&P sectors show that neither is expected to return to 2014 employment levels during the forecast period. Job growth is projected for the oil sands and pipelines sectors starting in 2017, and employment for both of these is anticipated to surpass 2014 levels by 2021.

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Oil and gas employment to 2021, by sub-sector

Figure 8 Sources: PetroLMI and Statistics Canada
Oil and gas services

By the end of 2016, the oil and gas services sector directly employed 81,500 workers. 2017 will be a challenging year regardless of the scenario for this sector, having lost 26% of its workforce in the two years prior. A number of occupations are forecast to experience labour shortages. In a survey of oil and gas companies in early February 2017, almost all service company respondents reported difficulties filling job vacancies. Companies indicated that some workers have been recalled and other positions have been filled through internal redeployments and transfers, but overall companies are challenged from an attraction and recruitment perspective. As a result, oil and gas services is the only sector contemplating compensation increases to address employee attraction and retention concerns.

"You’d think there are people looking for jobs now, but we struggle worse now than [we] ever did at our busiest point looking for people."
Abby Kradovill, Safety Co-ordinator, Miller Well Services

**Modest Recovery scenario**

In this scenario, the oil and gas services sector would add approximately 6,700 new jobs by the end of the forecast period, with more than half of the job gains in the early years.

In 2017 alone, the sector would create about 3,900 new jobs. The sector’s employment growth rate flattens in the medium-term, but the sector still gains an additional 2,800 new jobs between 2018 and 2021.

**Delayed Recovery scenario**

In this scenario, the sector experiences additional job losses in 2017 and only partially regains these from 2018 to 2021. As a result, the sector loses 600 jobs overall within the forecast period.

Age-related attrition could contribute to additional hiring needs

Up to 10,000 oil and gas service workers could retire within the forecast period. With concerns about the loss of experienced workers due to the downturn, retirement vacancies directly related to generating revenue, such as operators and trades, are more likely to be filled. Companies may also view age-related attrition as an opportunity to recruit workers with the technology skills that will be necessary in digitized oil and gas fields.
Innovation, efficiencies and their impact on the services sector

The oil and gas industry overall has improved its profitability by imposing cost cuts and efficiency gains on the oil and gas services sector in the last two years. Further reduction of service sector fees is not sustainable. Any additional cost, efficiency and productivity improvements are likely to come from innovation and technological advancements.

Occupational demand closely aligns, therefore, with the implementation of oil and gas drilling and service technology. The use of multi-pad horizontal drilling, multi-stage hydraulic fracturing and data collection technologies that increase production, while decreasing time and costs, have been accelerated during this downturn. The impact of innovative technology on the oil and gas services workforce includes the following:

- Multi-pad horizontal drilling takes longer but requires fewer rigs and therefore fewer drillers. The decrease in well pad and road construction has the most impact on heavy equipment operators – fewer rig moves means fewer requirements for trucks and drivers.
- Hydraulic fracturing is both equipment and labour intensive, increasing the need for fracturing operators, and truck drivers hauling sand and fluid.
- Increased digitization of the industry to enhance drilling and completions accuracy and productivity drives the need for data analytics and interpretation roles.

Going forward, the oil and gas services sector could see additional hiring if conventional E&P and oil sands companies address increased capital-related activity with the use of third-party contractors. Geological, engineering and trades occupations would see the greatest increase from the implementation of this strategy.

“We do believe the next innovation is not a machine or a component innovation, but how one coordinates and interrelates a machine and downhole operational data, creating algorithms that think and help drillers replicate best wellbores on a continuous basis.”

Bob Geddes, President and Chief Operation Office, Ensign Energy Services, February 6, 2017
### Top 10 oil and gas services occupations with greatest expansion demand to 2021, both scenarios

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total oil and gas services sector</strong></td>
<td>81,500</td>
<td>Modest</td>
<td>3,900 (+5%)</td>
<td>2,800 (+3%)</td>
<td>6,700 (+8%)</td>
</tr>
<tr>
<td><strong>Oil and gas well drillers, servicers, testers and related workers (8232)</strong></td>
<td>6,305</td>
<td>Modest</td>
<td>1,035 (+16%)</td>
<td>505 (+8%)</td>
<td>1,545 (+25%)</td>
</tr>
<tr>
<td><strong>Supervisors and contractors, oil and gas drilling and services (8222)</strong></td>
<td>4,530</td>
<td>Modest</td>
<td>745 (+16%)</td>
<td>365 (+8%)</td>
<td>1,110 (+24%)</td>
</tr>
<tr>
<td><strong>Oil and gas well drilling workers and service operators (8412)</strong></td>
<td>2,980</td>
<td>Modest</td>
<td>490 (+16%)</td>
<td>240 (+8%)</td>
<td>730 (+25%)</td>
</tr>
<tr>
<td><strong>Oil and gas drilling, servicing and related labourers (8615)</strong></td>
<td>2,910</td>
<td>Modest</td>
<td>480 (+17%)</td>
<td>235 (+8%)</td>
<td>710 (+24%)</td>
</tr>
<tr>
<td><strong>Millwrights (7311)</strong></td>
<td>3,010</td>
<td>Modest</td>
<td>30 (+1%)</td>
<td>95 (+3%)</td>
<td>125 (+4%)</td>
</tr>
<tr>
<td><strong>Truck drivers (7511)</strong></td>
<td>2,925</td>
<td>Modest</td>
<td>45 (+2%)</td>
<td>70 (+2%)</td>
<td>110 (+4%)</td>
</tr>
<tr>
<td><strong>Petroleum, gas, chemical process operators (no steam ticket required) (9232)</strong></td>
<td>2,235</td>
<td>Modest</td>
<td>5 (0%)</td>
<td>100 (+4%)</td>
<td>105 (+5%)</td>
</tr>
<tr>
<td><strong>Geologists and geophysicists (2113)</strong></td>
<td>1,335</td>
<td>Modest</td>
<td>65 (+5%)</td>
<td>40 (+3%)</td>
<td>105 (+8%)</td>
</tr>
<tr>
<td><strong>Geological, petroleum and mining technologists (2212)</strong></td>
<td>1,275</td>
<td>Modest</td>
<td>65 (+5%)</td>
<td>40 (+3%)</td>
<td>100 (+8%)</td>
</tr>
<tr>
<td><strong>Heavy equipment operators (except crane) (7521)</strong></td>
<td>2,520</td>
<td>Modest</td>
<td>40 (+2%)</td>
<td>60 (+2%)</td>
<td>95 (+4%)</td>
</tr>
</tbody>
</table>

Table 4  Source: PetroLMI
Notes: The top 10 occupations make up almost 40% of the sector’s 2016 employment and more than 70% of the sector’s overall expansion demand to 2021 in the Modest Recovery scenario. Numbers may not add up due to rounding. Refer to Appendix 3 for full list of occupational projections for the sector including replacement demand.
Conventional exploration and production

Canada’s conventional exploration and production (E&P) sector (excludes oil sands) employed about 53,800 direct employees at the end of 2016 having reduced close to 30% of its workforce in the last two years. While this sector could have additional job losses in 2017 in the Delayed Recovery scenario, overall workforce expansion is projected for both scenarios over the five-year forecast.

Until there is greater confidence that prices and investment have stabilized, some companies report a reluctance to add full-time employees and may instead rely on contractors to address increases in industry activity. If companies do hire contract workers, they may also negotiate for lower rates than in the past.

Like the oil and gas services sector, the conventional E&P sector will likely see greater demand for technical workers in order to optimize innovation and technology to further boost productivity and efficiencies. This sector’s success in this area in the coming years will have a key impact on the industry’s overall global competitiveness.

Modest Recovery scenario

In this scenario, the sector is expected to create 5,500 new jobs by 2021. Nearly 30% of this job growth, or 1,500 new workers, would need to be added in 2017.

The occupations expected to grow at a greater rate during the forecast period would be highly technical positions that support capital activity. These workers are also required to optimize drilling, completions and production technologies. Conventional E&P employment is not expected to recover to 2014 levels in the short-term and since these occupations do not transfer as easily into other industries, labour supply is expected to be more readily available when required.

In this scenario about 4,000 positions would be added between 2018 and 2021.

Innovation and technology to further boost productivity and efficiencies within the E&P sector will have a key impact on the industry’s overall global competitiveness.

### Occupations with greatest job gains expected in 2017 (Modest Recovery):

1. Purchasing agents and officers including landmen
2. Managers in natural resources production, drilling and well servicing
3. Geologists and geophysicists
4. Supervisors and contractors, oil and gas drilling and services
5. Petroleum engineers
6. Geological, petroleum and mining technologists
7. Inspectors in public and environmental health and safety
8. Power engineers and power systems operators
9. Industrial electricians
10. Chemical engineers
Delayed Recovery scenario

In this scenario, job growth does not occur until 2018 and limits overall growth to 2,600 new jobs from 2017 to 2021.

In 2017, the sector is forecast to cut approximately 2,300 jobs. But then, the industry quickly ramps up activity to realize production gains, resulting in 4,900 new jobs created between 2018 and 2021.

Similar occupations that would experience increased hiring in the Modest Recovery scenario are at risk for further job cuts if capital investment is delayed.

In this scenario, companies will likely try to maintain a lean workforce and sustain operational efficiency by focusing on their highest quality assets, streamlining operations and implementing process improvements.

“"We have to be prepared for the possibility that oil prices are going to remain lower and more volatile for an extended period of time ... US$30 a barrel oil is barely in the rear view mirror. Companies will be relatively careful, certainly about taking on permanent staff. As activity ramps up, you are going to see more people employed in drilling and completing wells and work out in the field, but in the head office area, it’s going to be slow to see numbers increase.”

Robert Peabody, President and CEO, Husky Energy Inc. February 2, 2017

Occupations with greatest job losses in 2017 (Delayed Recovery):

1. Purchasing agents and officers including landmen
2. Supervisors and contractors, oil and gas drilling and services
3. Managers in natural resources production, drilling and well servicing
4. Geologists and geophysicists
5. Petroleum engineers
6. Petroleum, gas, chemical process operators (no steam ticket required)
7. Oil and gas well drillers, servicers, testers and related workers
8. Heavy equipment operators (except crane)
9. Power engineers and power systems operators
10. Oil and gas well drilling workers and service operators

Age-related attrition could contribute to additional hiring needs

About 7,000 conventional E&P workers could retire within the forecast period. Engineering, operations and geoscience roles are more likely to be filled as the sector looks for additional productivity in the field.
## Top 10 conventional E&P occupations with greatest expansion demand to 2021, both scenarios

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2017</td>
</tr>
<tr>
<td>Total conventional E&amp;P sector</td>
<td>53,800</td>
<td>Modest</td>
<td>1,500 (+3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-2,300 (-4%)</td>
</tr>
<tr>
<td>Purchasing agents and officers including landmen (1225)</td>
<td>2,140</td>
<td>Modest</td>
<td>265 (+12%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-165 (-8%)</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing (0811)</td>
<td>1,520</td>
<td>Modest</td>
<td>170 (+11%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-110 (-7%)</td>
</tr>
<tr>
<td>Supervisors and contractors, oil and gas drilling and services (8222)</td>
<td>3,365</td>
<td>Modest</td>
<td>110 (+3%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-155 (-5%)</td>
</tr>
<tr>
<td>Geologists and geophysicists (2113)</td>
<td>1,835</td>
<td>Modest</td>
<td>115 (+6%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-105 (-6%)</td>
</tr>
<tr>
<td>Petroleum engineers (2145)</td>
<td>1,940</td>
<td>Modest</td>
<td>95 (+5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-100 (-5%)</td>
</tr>
<tr>
<td>Geological, petroleum and mining technologists (2212)</td>
<td>685</td>
<td>Modest</td>
<td>5 (+1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-50 (-7%)</td>
</tr>
<tr>
<td>Power engineers and power systems operators (9241)</td>
<td>1,295</td>
<td>Modest</td>
<td>30 (+2%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-55 (-4%)</td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) (7521)</td>
<td>1,505</td>
<td>Modest</td>
<td>15 (+1%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-55 (-4%)</td>
</tr>
<tr>
<td>Inspectors in public and environmental health and safety (2263)</td>
<td>675</td>
<td>Modest</td>
<td>35 (+5%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-35 (-5%)</td>
</tr>
<tr>
<td>Industrial electricians (7242)</td>
<td>420</td>
<td>Modest</td>
<td>25 (+6%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-25 (-6%)</td>
</tr>
</tbody>
</table>

Table 5: Source: PetroLMI

Note: The top 10 occupations make up close to 30% of the sector’s 2016 employment and about 45% of the sector’s overall expansion demand to 2021 in the Modest Recovery scenario. Numbers may not add up due to rounding. Refer to Appendix 4 for full list of occupational projections for the sector including replacement demand.
Despite production increases, deeper than expected job losses in 2015 and 2016 (8% contraction) resulted in approximately 28,900 workers directly employed in Canada’s oil sands sector at the end of 2016. (See PetroLMI’s Oil Sands Labour Demand Outlook to 2020 Update, released December 2016).

For the oil sands sector, only one scenario is presented, because of one set of assumptions for oil sands investments and production. Total employment growth is expected to be 4,000 by 2021.

In 2017, the workforce requirements will reflect the transition of capital projects into operation. In oil sands mining operations the growth is expected to occur in production-related jobs. The addition of operations roles will be somewhat offset by the loss of capital-related jobs as major projects that were under construction prior to the downturn move into operation in 2017 and 2018. In situ operations will add workers as additional production comes on stream. Meanwhile, there will be a decrease in the number of upgrading jobs as investment in this sub-sector slows considerably following completion of projects currently under construction.

The continued focus on decreasing costs, increasing operational efficiencies and sustaining labour productivity gains will have an impact on oil sands workforce requirements between 2018 and 2021. Jobs added in the forecast period will be primarily in occupations that support production as well as the maintenance and optimization of existing operations. The sector is also expected to enhance operational productivity through technology, including additional automation.

The oil sands sector is expected to fully recover the jobs lost in 2015 and 2016 and surpass 2014 employment levels within the forecast period.

<table>
<thead>
<tr>
<th>2016 Estimated Employment</th>
<th>2017</th>
<th>2018–2021</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>28,900</td>
<td>300</td>
<td>3,700</td>
<td>4,000</td>
</tr>
<tr>
<td>(2,400 jobs lost since 2014)</td>
<td>(+1%)</td>
<td>(+13%)</td>
<td>(+14%)</td>
</tr>
</tbody>
</table>

Figure 11 Source: PetroLMI

Occupations with greatest job gains in 2017:
1. Heavy equipment operators (except crane)
2. Power engineers and power systems operators
3. Heavy-duty equipment mechanics
4. Managers in natural resources production, drilling and well servicing
5. Industrial electricians
6. Millwrights
7. Petroleum, gas, chemical process operators (no steam ticket required)
8. Welders
9. Facility operation and maintenance managers
10. Instrumentation technicians

Occupations with greatest job losses in 2017:
1. Construction managers
2. Petroleum engineers
3. Mechanical engineers
4. Electrical/instrumentation engineers
5. Chemical engineers
6. Geologists and geophysicists
7. Drafting technologists and technicians
8. Mining engineers
9. Civil engineering technologists and technicians
10. Mechanical engineering technologists and technicians
The maintenance capital is not insignificant for oilsands. I think that’s the silver lining to the situation. We’re not going to have the peak spending that we had in 2014 for the foreseeable future but we need to consider that there will be potentially as much as $13 billion per year sustaining capital spent.”

Jackie Forrest, Vice President, ARC Energy Research Institute

Oil sands expansion demand to 2021, by operations type

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Total oil sands sector</td>
<td>28,900</td>
<td>32,900</td>
<td>+4,000 (+14%)</td>
</tr>
<tr>
<td>Mining</td>
<td>14,800</td>
<td>17,400</td>
<td>+2,600 (+18%)</td>
</tr>
<tr>
<td>In situ</td>
<td>9,200</td>
<td>11,200</td>
<td>+2,000 (+22%)</td>
</tr>
<tr>
<td>Upgrading</td>
<td>4,900</td>
<td>4,300</td>
<td>-600 (-12%)</td>
</tr>
</tbody>
</table>

Table 6: Source: PetroLMI
Note: Detailed labour demand projections to 2020 for oil sands by sub-sector and by occupation is located here.

Oil sands mining, in situ and upgrading operations

Oil sands are dug up and loaded into trucks.

They are taken to crushers.

They are mixed with hot water and sent to extraction.

Raw bitumen is extracted from the sand and water.

Solvents are added to the raw bitumen to remove remaining minerals and water.

The bitumen is heated to remove excess carbon to create synthetic crude oil.

Steam is injected into the reservoir to soften the bitumen.

The softened bitumen is pumped to the surface.

The bitumen is transported to markets either before or after upgrading.

Source: PetroLMI

Oil and Gas Sub-Sector Analysis

Hiring across all of the oil sands sub-sectors over the five-year period will be impacted by the decrease in growth-related capital spending and a shift towards sustaining and maintenance projects that drive operational reliability and efficiency. There will be concerted efforts to sustain labour productivity improvements realized in 2015 and 2016. All of the hiring is likely to undergo deeper scrutiny to determine if and how to fill open positions. There is also expected to be more reliance on independent and third-party contractors for operations and maintenance work and to address fluctuating workforce demand.

Future growth in oil sands is likely to be through smaller, phased-in production expansions that can be ramped up over a shorter time period if oil price and cost environments stabilize or improve.
Top 10 oil sands occupations with greatest expansion demand to 2021 (one scenario)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total oil sands sector</td>
<td>28,900</td>
<td>4,000 (+14%)</td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) (7521)</td>
<td>4,505</td>
<td>1,000 (+22%)</td>
</tr>
<tr>
<td>Power engineers and power systems operators (9241)</td>
<td>4,915</td>
<td>795 (+16%)</td>
</tr>
<tr>
<td>Heavy-duty equipment mechanics (7312)</td>
<td>1,400</td>
<td>290 (+21%)</td>
</tr>
<tr>
<td>Facility operation and maintenance managers (0714)</td>
<td>1,265</td>
<td>165 (+13%)</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing (0811)</td>
<td>780</td>
<td>150 (+19%)</td>
</tr>
<tr>
<td>Industrial electricians (7242)</td>
<td>765</td>
<td>145 (+19%)</td>
</tr>
<tr>
<td>Millwrights (7311)</td>
<td>715</td>
<td>135 (+19%)</td>
</tr>
<tr>
<td>Engineering managers (0211)</td>
<td>1,100</td>
<td>120 (+11%)</td>
</tr>
<tr>
<td>Petroleum, gas, chemical process operators (no steam ticket required) (9232)</td>
<td>520</td>
<td>110 (+22%)</td>
</tr>
<tr>
<td>Instrumentation technicians (2243)</td>
<td>725</td>
<td>95 (+13%)</td>
</tr>
</tbody>
</table>

Table 7: Source: PetroLMI

Note: The top 10 occupations make up close to 60% of the sector’s 2016 employment and over 70% of the sector’s overall expansion demand to 2021 in the Modest Recovery scenario. Refer to Appendix 5 for full list of occupational projections for the sector including replacement demand.

Age-related attrition could contribute to additional hiring needs

Approximately 4,000 oil sands employees could retire within the forecast period. Positions on the front line of production, such as operators, trades and engineers, are more likely to be filled than positions that have less direct impact on production.

Photo credit: Cenovus Energy Inc.
Pipelines

The pipelines sector entered 2017 with significant advancements in the approval of Canadian pipeline projects. Additionally, some pipeline companies made significant acquisitions in 2016, while others were awarded the construction and operation of pipeline projects in Mexico. All that bodes well for the sector.

Canada’s pipeline operations\(^8\) employed an estimated 9,700 direct workers at the end of 2016 after reducing 6% of its workforce in the last two years. In both the Moderate and Delayed Recovery scenarios, workforce levels are expected to recover the jobs lost during 2015 and 2016, with the majority of hiring occurring early in the forecast period.

At the same time, however, job growth will be tempered with the implementation of advanced technologies, including automation.

Modest Recovery scenario

In this scenario, pipeline operations employment is projected to grow in 2017 by more than 450 jobs. Hiring is expected to include a combination of field operations workers and those involved in capital-related work, including the planning for expansion projects.

After 2017, hiring is expected to increase for pipeline expansions that support additional natural gas production. Staffing up for expansions is expected to continue between 2018 and 2021 with close to 550 new jobs added, bringing overall employment growth to almost 1,000 new jobs within the five-year forecast.

Delayed Recovery scenario

In this scenario, the pipelines sector is expected to create a total of 800 new jobs from 2017 to 2021 with half of this growth, or 400 jobs created in 2017. In this scenario, the more moderate growth of natural gas production has an impact on employment after 2017.

Portions of Canadian pipelines could also be decommissioned. Shifts in pipeline transmission, along with implementation of automation and other technologies, would reduce job creation between 2018 and 2021 to about 400.

Occupations with greatest job gains in 2017 (similar in both scenarios):

1. Petroleum, gas, chemical process operators (no steam ticket required)
2. Millwrights
3. Supervisors, petroleum, gas and chemical processing and utilities
4. Chemical engineers
5. Mechanical engineers
6. Purchasing agents and officers including landmen
7. Engineering managers
8. Inspectors, testers and technicians (non-destructive)
9. Civil engineering technologists and technicians
10. Civil engineers

\(^8\)The employment projections and analysis in this section refer only to the operation of large diameter oil and natural gas pipelines. Wind and nuclear electricity generation, natural gas processing, gas utilities, etc. that are the businesses of some Canadian pipeline companies are not included in the numbers. Nor do the projections capture the contingent workforce or U.S. operations. Some conventional E&P companies also hire for pipeline operations positions.
## Top 10 pipeline occupations with greatest expansion demand to 2021, both scenarios

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total pipelines sector</strong></td>
<td>9,700</td>
<td>Modest</td>
<td>1,000 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>800 (+8%)</td>
</tr>
<tr>
<td>Petroleum, gas, chemical process operators [No steam ticket required] [9232]</td>
<td>1,060</td>
<td>Modest</td>
<td>107 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>87 (+8%)</td>
</tr>
<tr>
<td>Millwrights [7311]</td>
<td>275</td>
<td>Modest</td>
<td>27 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>23 (+8%)</td>
</tr>
<tr>
<td>Supervisors, petroleum, gas and chemical processing and utilities [9212]</td>
<td>235</td>
<td>Modest</td>
<td>24 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>19 (+8%)</td>
</tr>
<tr>
<td>Chemical engineers [2134]</td>
<td>210</td>
<td>Modest</td>
<td>22 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>18 (+8%)</td>
</tr>
<tr>
<td>Mechanical engineers [2132]</td>
<td>190</td>
<td>Modest</td>
<td>20 (+11%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>16 (+8%)</td>
</tr>
<tr>
<td>Purchasing agents and officers including landmen [1225]</td>
<td>185</td>
<td>Modest</td>
<td>19 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>16 (+9%)</td>
</tr>
<tr>
<td>Engineering managers [0211]</td>
<td>160</td>
<td>Modest</td>
<td>17 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>14 (+9%)</td>
</tr>
<tr>
<td>Petroleum engineers [2145]</td>
<td>155</td>
<td>Modest</td>
<td>15 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>12 (+8%)</td>
</tr>
<tr>
<td>Truck drivers [7511]</td>
<td>140</td>
<td>Modest</td>
<td>14 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>12 (+9%)</td>
</tr>
<tr>
<td>Inspectors, testers and technicians [non-destructive] [2261]</td>
<td>125</td>
<td>Modest</td>
<td>13 (+10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>10 (+8%)</td>
</tr>
</tbody>
</table>

Table 8  Source: PetroLMI

Note: The top 10 occupations make up close to 30% of the sector’s 2016 employment and overall expansion demand to 2021 in both the Modest and Delayed Recovery scenarios. Due to smaller labour demand numbers for the sector and to allow for differentiation within the table: occupational expansion demand numbers were not rounded but sector totals were rounded to the nearest hundred. Refer to Appendix 6 for full list of occupational projections for the sector including replacement demand.
Canada's oil and gas industry achieved a key milestone towards market diversification in 2016 with the approval of two oil pipelines and one pipeline to transport natural gas to a proposed LNG plant on the west coast. Planning also continues for an oil pipeline to eastern Canada and there are a number of smaller pipeline construction projects underway. Additionally, there is potential for the Keystone XL pipeline to move ahead, transporting oil into the United States.

The workforce required to construct a pipeline is much greater than the number of workers required during the operations phase. The availability of skilled labour will be essential, especially if multiple projects move forward at the same time. Additionally, like other industry sectors, pipeline companies are evaluating their assets and there is potential for uneconomic, underutilized pipelines to be decommissioned. This would further increase demand for construction workers.

The CEPA Foundation commissioned a study to assess the workforce demand for critical occupations to construct Canada’s pipelines. Recognizing that the timing of projects and workforce demand will be dependent on price, it was assumed that smaller projects would move forward on sustained oil price above US$60/bbl, while large capital projects are likely contingent on above US$70/bbl. Timing of regulatory approval will also be a factor.

Demand for critical occupations is expected to start increasing in 2017 as smaller construction projects move forward. Large capital project construction demand is expected to create a significant increase in demand starting in 2019 with 7,600 full-time equivalent (FTE) jobs. This number is projected to peak in 2021 with 15,950 FTE. Welders, heavy equipment operators (except crane) and construction trades and labourers are expected to comprise more than 66% of the critical occupation demand at peak.

Demand, combined with loss of construction labour supply and retirements, is expected to cause a labour demand-supply gap for the pipeline construction of almost 12,000 FTE in 2021. Occupations with the greatest gap (in FTE) include:

- Construction trades helpers and labourers (5,556)
- Heavy equipment operators (except crane) (2,245)
- Welders and related machine operators (1,949)
- Industrial painters, coaters and metal finishing process operators (931)
- Construction managers (720)
- Inspectors in public and environmental health and occupational health and safety (587)


Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)
Oil and Gas Activity Supports Jobs Across Canada

Oil and gas activity occurs in 12 of Canada’s 13 provinces and territories. With oil prices trending around US$50 in the first quarter of 2017, new investment occurring in the industry is shifting to more traditional regions in the Western Canadian Sedimentary Basin (WCSB) that spans British Columbia, Alberta and Saskatchewan.

The oil and gas plays receiving the most attention are those offering producers the greatest profitability in a restructured price and cost environment, including:

- Reserves that respond to technology that enhances well efficiency and productivity, such as multi-pad horizontal drilling and multi-stage hydraulic fracturing,
- Reserves in regions that have established infrastructure including roads, pipelines and processing facilities.

Going forward, fiscal and regulatory environments will also continue to have an impact on attracting investment to certain jurisdictions.

Summary of industry activity by region

According to the Canadian Association of Petroleum Producers (CAPP), the Montney, Durvenay, Cardium and Viking plays of the WCSB have experienced the greatest increase in recent renewed activity. That said, activity forecasts provided by the Petroleum Services Association of Canada (PSAC) and Canadian Association of Oilwell Drilling Contractors (CAODC) continue to call for the number of wells to be drilled and rig operating days to be down by 54% and 62% respectively from 2014 levels.¹

Provincially, activity in a Modest Recovery scenario is anticipated as follows:

**British Columbia:** a significant portion of the liquids-rich Montney lies in Northeast BC. Improved economics and investment in new processing facilities and pipelines to transport natural gas supply to markets is having a positive impact on natural gas activity in the region. For instance, single day land sales in early 2017 were greater than all auctions held in 2015 and 2016. PSAC’s January 2017 Canadian Drilling Activity Forecast Update projects a 15% increase in the number of wells drilled in BC, from 320 wells in 2016 to 367 wells in 2017.

**Alberta:** all four of the oil and gas plays which have experienced an uptick in activity in early 2017 are located in Alberta. As a result, the province is projected to see the greatest rebound in drilling activity with 2,706 wells drilling – a 47% increase or 806 additional wells over 2016 levels. The west, central and northwest regions of the province are expected to be the busiest through 2017.

Despite an anticipated decrease in spending during the forecast period, the oil sands sector is expected to generate activity and employment to 2021 due to increased maintenance and production requirements – especially if cost structures remain low and oil prices stabilize above US$50. Planned expansion projects that were suspended in 2015 and 2016 could resume before 2021 if economics are determined to be favourable.

**Saskatchewan:** the Viking light oil play stretches into Saskatchewan. With an industry-friendly regulatory environment, its light oil reserves are attractive to capital investment; however, the province does not have the scale of reserves found elsewhere. Still, Saskatchewan is expected to experience a 17% increase in the number of wells drilled in 2017, 1,985 wells compared to 1,700 in 2016.


Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)
**Rest of Canada**

The majority of Canadian oil and gas activity outside of the WCSB takes place offshore in Eastern Canada, including three offshore oil producing fields in Newfoundland and Labrador and two offshore natural gas producing fields in Nova Scotia.

Hebron, a fourth offshore oil project in Newfoundland and Labrador, which has provided a massive injection of construction jobs into the province, is near completion and expected to move into production in 2017. Conversely, the Sable Offshore Energy Project, is nearing the end of its natural gas production cycle and decommissioning could begin as early as 2017.

Like the oil sands, Canada’s offshore experienced the deferral of expansion projects during the last two years but offshore operators are undertaking some exploration drilling and are reviewing their options for cost-effective expansions. No final investment decisions were made by the end of first quarter 2017.
Employment impacts on oil and gas activity across Canada (Delayed – Modest Recovery scenario)

While direct industry employment is concentrated in regions with the greatest oil and gas production, indirect employment is widespread as the industry sources goods and services from across Canada.

Based on production and investment projections for both scenarios, an estimated annual average of 508,000 to 554,000 direct and indirect jobs respectively will be supported by the oil and gas industry throughout Canada between 2017 and 2021.

A third category is referred to as induced employment and includes employment generated due to consumer spending by direct and indirect workers. Oil and gas-related induced employment accounts for another 208,000 to 226,400 jobs per year to 2021.

In total, oil and gas capital and operating spending will sustain between 716,100 and 780,800 Canadian jobs annually between 2017 and 2021.

Indirect and induced job creation from oil and gas activity

- British Columbia-based jobs each year: 52,500–61,600
- Alberta-based jobs each year: 239,200–365,700
- Saskatchewan-based jobs each year: 26,300–30,500
- Atlantic Canada-based jobs each year: 15,200–17,900
- Ontario-based jobs each year: 53,400–56,900
- Rest of Canada jobs each year: 21,400

Source: PetroLMI using Statistics Canada’s Input-Output tables.
Conclusion

Over the next five years the exact timing and level of expansion in Canada’s oil and gas industry is dependent on a number of factors, with 2017 being the pivotal year to set the stage for oil prices, investment and employment growth.

2017 started out promising with oil prices trending around US$50/bbl. If a balanced global oil supply/demand and $55 average oil price is achieved in 2017, there will be increased spending and employment. Should oil prices stay below $50, industry will resume cost-cutting measures and recovery and growth will be delayed until 2018.

Should oil prices land more favourably and rise steadily in the next five years, the industry is expected to create 17,100 new jobs by 2021. If lower oil prices continue in 2017 and growth is delayed until 2018, the industry will only gain about 6,700 net new jobs in the same time period.

Some portion of the estimated 22,000 to 23,000 job vacancies that will occur due to age-related attrition during the five-year period will also contribute to increased hiring activity, but the number and types of occupations remain less certain.

The assumption that the deep employment cuts in 2015 and 2016 will leave the oil and gas industry with readily available workers is not the case. Already, labour shortages are occurring. Going forward, the industry’s unemployment rate is projected to fall below 2014 levels, mainly due to a shrinking labour force. This will further escalate a third year of contraction, pushing even more unemployed oil and gas workers and potential new entrants, including new graduates into other industries.

Regardless of the pace of job creation, growth is projected to plateau in 2020–2021 because of productivity improvements and Canada’s limited ability to compete in the global energy market – at least within the five-year forecast.

To sustain growth beyond 2021, market diversification is required. The United States, traditionally Canada’s primary consumer, has fast emerged as a key competitor – for both market share and industry investments. Maintaining a lean and productive workforce, as well as operational efficiencies through innovation and technology, will be key to remaining competitive. Canada’s industry will also need to focus on effectively managing the labour and skill shortages that have impacted costs and productivity in the past.

At the same time the industry’s workforce will play a key role in its ability to compete globally. Their technical skills and knowledge will lead to further innovation and the development of technology to facilitate the industry’s transition to a global energy supplier while managing widening competitive pressures and new carbon regulations.

“The Canadian oilfield service, supply and manufacturing sector is a leader in providing innovation and technological support for Canada’s responsibly-developed oil and gas resources and like our customers, the producers, we are limited in our growth here in Canada as long as we only have one customer, the U.S., a customer that has quickly become our biggest competitor.”

Mark Salkeld, President, Petroleum Services Association of Canada

Photo credit: Nexen
Appendices

Appendix 1: National Occupational Classification (NOC) and Sample Industry Job Titles

The following table provides sample job titles for the 48 and other occupations mapped to NOC 2011 version.

<table>
<thead>
<tr>
<th>NOC Title and Code</th>
<th>Oil and gas services</th>
<th>Conventional E&amp;P</th>
<th>Oil sands</th>
<th>Pipelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical engineers (2134)</td>
<td>Field engineer, drilling engineer, well engineer, measurement while drilling specialist, technical engineer</td>
<td>Production engineer, reservoir engineer, reliability engineer, drilling and completions engineer, exploitation engineer</td>
<td>Chemical engineer, process engineer</td>
<td>Pipeline engineer, inspection engineer, pipeline integrity engineer, corrosion engineer</td>
</tr>
<tr>
<td>Chemical technologists and technicians (2211)</td>
<td>Field technician, field operations technologist</td>
<td>Chemical engineering technologist, production technologist, reservoir technologist, quality assurance analyst</td>
<td>Process technician, chemical engineering technologist, quality assurance analyst, lab technician</td>
<td>Pipeline integrity technician, corrosion specialist</td>
</tr>
<tr>
<td>Civil engineers (2131)</td>
<td>Civil engineer, project engineer</td>
<td>Civil engineer, project engineer</td>
<td>Civil engineer, geotechnical engineer, piping engineer, project engineer</td>
<td>Civil engineer, inspection engineer, pipeline integrity engineer, project engineer</td>
</tr>
<tr>
<td>Construction managers (0711)</td>
<td>Construction manager, project manager, site superintendent</td>
<td>Construction manager, project manager, site superintendent</td>
<td>Construction manager, project manager, site superintendent</td>
<td>Construction manager, project manager, site superintendent, pipeline construction manager</td>
</tr>
<tr>
<td>Crane operators (7371)</td>
<td>Crane operator</td>
<td>Crane operator</td>
<td>Crane operator, mobile crane operator</td>
<td>Crane operator</td>
</tr>
<tr>
<td>Drafting technologists and technicians (2253)</td>
<td>Drafting technologist, CAD technologist</td>
<td>Drafting technologist, CAD technologist</td>
<td>Drafting technologist, CAD technologist</td>
<td>Pipeline design technologist, piping technologist, drafting technologist, CAD technologist</td>
</tr>
<tr>
<td>Electrical/instrumentation engineers (2133)</td>
<td>Electrical engineer, instrumentation engineer</td>
<td>Electrical/instrumentation engineer, project engineer</td>
<td>Electrical/instrumentation engineer, project engineer, electrical/instrumentation reliability engineer, control systems specialist</td>
<td>Electrical/instrumentation engineer, project engineer</td>
</tr>
</tbody>
</table>

Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)
<table>
<thead>
<tr>
<th>NOC Title and Code (cont.)</th>
<th>Sample Job Titles per Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oil and gas services</td>
</tr>
<tr>
<td>Engineering managers (0211)</td>
<td>Manager quality assurance, manager civil engineering, manager mechanical engineering, manager electrical engineering, manager quality control</td>
</tr>
<tr>
<td>Facility operation and maintenance managers (0714)</td>
<td>Maintenance manager, facility manager, operations manager, plant maintenance superintendent</td>
</tr>
<tr>
<td>Geological, petroleum and mining technologists (2212)</td>
<td>Petroleum engineering technologist, technical specialists (fracturing, coiled tubing, etc.), engineering technician, measurement while drilling or field specialist</td>
</tr>
<tr>
<td>Geologists and geophysicists (2113)</td>
<td>Geologist, geophysicist</td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) (7421)</td>
<td>Heavy equipment operator</td>
</tr>
<tr>
<td>Heavy-duty equipment mechanics (7312)</td>
<td>Heavy-duty mechanic, heavy-duty technician</td>
</tr>
<tr>
<td>Industrial and manufacturing engineers (2141)</td>
<td>Project engineer, quality control engineer</td>
</tr>
<tr>
<td>Industrial electricians (7242)</td>
<td>Industrial electrician, electrician, electrical technician</td>
</tr>
<tr>
<td>Industrial engineering and manufacturing technologists and technicians (2233)</td>
<td>Industrial engineering technologist, engineering technologist</td>
</tr>
<tr>
<td>Inspectors in public and environmental health and safety (2263)</td>
<td>Health &amp; safety inspector, EH&amp;S specialist, OHSE field advisor</td>
</tr>
<tr>
<td>Inspectors, testers and technicians (non-destructive) (2261)</td>
<td>Quality assurance analyst, mechanical QA, QA/QC inspector, coordinator</td>
</tr>
<tr>
<td>NOC Title and Code (cont.)</td>
<td>Sample Job Titles per Sector</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>Oil and gas services</td>
</tr>
<tr>
<td>Instrumentation engineering technologists (2241)</td>
<td>Instrumentation technologist, instrumentation technician</td>
</tr>
<tr>
<td>Instrumentation technicians (2243)</td>
<td>Instrumentation technician, instrumentation mechanic, service technician, field services technician</td>
</tr>
<tr>
<td>Insulators (7293)</td>
<td>Insulator</td>
</tr>
<tr>
<td>Machinists and machining and tooling inspectors (7231)</td>
<td>Machinist, CNC machinist</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing (0811)</td>
<td>Drilling coordinator, production engineer, production manager</td>
</tr>
<tr>
<td>Mechanical engineering technologists (2232)</td>
<td>Engineering technician, hydraulic technician, field operations technologist</td>
</tr>
<tr>
<td>Mechanical engineers (2132)</td>
<td>Technical engineer, mechanical engineer</td>
</tr>
<tr>
<td>Millwrights (7311)</td>
<td>Millwright, maintenance mechanic</td>
</tr>
<tr>
<td>Mining engineers (2143)</td>
<td>Mining engineer</td>
</tr>
<tr>
<td>Natural and applied science policy researchers, consultants and program officers (4161)</td>
<td>Environmental technician, emergency preparedness analyst, waste management coordinator, environmental advisor</td>
</tr>
<tr>
<td>NOC Title and Code (cont.)</td>
<td>Sample Job Titles per Sector</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Oil and gas drilling, servicing and related labourers (8615)</td>
<td>Labourer, floorhand, leasehand, roustabout, seismic surveyor, vibrator operator, observer</td>
</tr>
<tr>
<td>Oil and gas well drillers, servicers, testers and related workers (8232)</td>
<td>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, logger, tester</td>
</tr>
<tr>
<td>Oil and gas well drilling workers and service operators (8412)</td>
<td>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 (DST) operator, fishing tool operator, fracturing equipment operator, logging &amp; coring operator, nitrogen operator, swabbing unit operator, fracturing operator, directional driller, measurement while drilling (MWD) specialist/operator, driller, rig technician</td>
</tr>
<tr>
<td>Petroleum engineers [2145]</td>
<td>Petroleum engineer, field engineer, production operations engineer, field operations engineer, technical engineer</td>
</tr>
<tr>
<td>Petroleum, gas, chemical process operators (no steam-ticket required) [9232]</td>
<td>Cementing plant operator, drilling fluids plant operator, bulk plant operator, plant operator</td>
</tr>
<tr>
<td>NOC Title and Code (cont.)</td>
<td>Sample Job Titles per Sector</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td><strong>Petroleum/mining/geological engineering technologists (2212)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Petroleum engineering technologist, technical specialist (fracturing, coil tubing, etc.), engineering technician, measurement while drilling specialist, field specialist</td>
<td>Petroleum engineering technologist, reservoir technologist, geological technologist, production technician</td>
</tr>
<tr>
<td><strong>Power engineers and power systems operators (9241)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Process operator, power engineer, steam-ticketed operator, cementing plant operator, drilling fluids plant operator, 5th class power engineer</td>
<td>Plant operator, gas plant operator, field operator, production technician, 1st, 2nd, 3rd and 4th class power engineer</td>
</tr>
<tr>
<td><strong>Production logistics co-ordinators (1523)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Production clerk</td>
<td>Production accountant, production clerk</td>
</tr>
<tr>
<td><strong>Professional occupations in advertising, marketing and public relations (1123)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Communications specialist, community relations advisor, Aboriginal relationship specialist, stakeholder relationship specialist, public relations coordinator</td>
<td>Communications specialist, community relations advisor, Aboriginal relationship specialist, stakeholder relationship specialist, public relations coordinator</td>
</tr>
<tr>
<td><strong>Purchasing agents and officers, including landmen (1225)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Purchaser, materials coordinator, buyer, procurement</td>
<td>Landman, contract administrator, contract manager, contract specialist, procurement specialist, buyer</td>
</tr>
<tr>
<td><strong>Purchasing and inventory control workers (1524)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Inventory planner, invoice control clerk, procurement coordinator</td>
<td>Inventory planner, invoice control clerk, procurement coordinator</td>
</tr>
<tr>
<td><strong>Purchasing managers (0113)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Contract manager, supply manager, procurement manager, material manager, supply chain manager, logistics manager</td>
<td>Contract manager, supply manager, procurement manager, material manager, supply chain manager, logistics manager</td>
</tr>
<tr>
<td><strong>Shippers and receivers (1521)</strong></td>
<td><strong>Oil and gas services</strong></td>
</tr>
<tr>
<td>Shipping agent, warehouse clerk, supply chain assistant</td>
<td>Shipping agent, warehouse clerk, supply chain assistant</td>
</tr>
<tr>
<td>NOC Title and Code (cont.)</td>
<td>Sample Job Titles per Sector</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td></td>
<td>Oil and gas services</td>
</tr>
<tr>
<td>Steamfitters and pipefitters [7252]</td>
<td>Steamfitter, pipefitter</td>
</tr>
<tr>
<td>Supervisors and contractors, heavy equipment operator crews [7302]</td>
<td>Oilfield construction supervisor, foreman, heavy construction, road construction supervisor</td>
</tr>
<tr>
<td>Supervisors, oil and gas drilling and services [8222]</td>
<td>Rig manager, service rig manager, field supervisor, fracturing supervisor, drilling rig manager, seismic field operations supervisor</td>
</tr>
<tr>
<td>Supervisors, petroleum, gas and chemical processing and utilities [9212]</td>
<td>Petroleum field supervisor, blending plant supervisor, water treatment supervisor, pumping and blending supervisor</td>
</tr>
<tr>
<td>Supervisors, supply chain, tracking and scheduling coordination occupations [1215]</td>
<td>Crew scheduler, transportation logistics coordinator, transportation planning coordinator</td>
</tr>
<tr>
<td>Truck drivers [7411]</td>
<td>Transportation operator, Class 1 truck driver, Class 3 truck driver</td>
</tr>
<tr>
<td>Welders [7265]</td>
<td>Welder, B-pressure welder</td>
</tr>
<tr>
<td>Other occupations</td>
<td>Includes occupations in human resources, accounting and finance, IT, administrative assistance, legal and other corporate services.</td>
</tr>
</tbody>
</table>
## Appendix 2: Total Industry Labour Demand to 2021, by Occupation

<table>
<thead>
<tr>
<th>Occupation (NOC)</th>
<th>2016 Estimated Employment</th>
<th>2017 Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Scenario</td>
<td>2017 (a)</td>
<td>2018-2021 (b)</td>
</tr>
<tr>
<td>Total industry</td>
<td>173,945</td>
<td>Modest</td>
<td>6,000</td>
<td>11,100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-8,700</td>
<td>15,400</td>
</tr>
<tr>
<td>Chemical engineers [2134]</td>
<td>1,402</td>
<td>Modest</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-60</td>
<td>95</td>
</tr>
<tr>
<td>Chemical technologists and technicians [2211]</td>
<td>711</td>
<td>Modest</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-40</td>
<td>55</td>
</tr>
<tr>
<td>Civil engineering technologists and technicians [2231]</td>
<td>386</td>
<td>Modest</td>
<td>-5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-15</td>
<td>15</td>
</tr>
<tr>
<td>Civil engineers [2131]</td>
<td>587</td>
<td>Modest</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-30</td>
<td>50</td>
</tr>
<tr>
<td>Construction managers [0711]</td>
<td>706</td>
<td>Modest</td>
<td>-25</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-65</td>
<td>30</td>
</tr>
<tr>
<td>Crane operators [7371]</td>
<td>467</td>
<td>Modest</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-30</td>
<td>30</td>
</tr>
<tr>
<td>Drafting technologists and technicians [2253]</td>
<td>439</td>
<td>Modest</td>
<td>-5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-40</td>
<td>25</td>
</tr>
<tr>
<td>Electrical/instrumentation engineers [2133]</td>
<td>1,027</td>
<td>Modest</td>
<td>-25</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-55</td>
<td>50</td>
</tr>
<tr>
<td>Engineering managers [0211]</td>
<td>1,662</td>
<td>Modest</td>
<td>20</td>
<td>155</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-15</td>
<td>160</td>
</tr>
<tr>
<td>Facility operation and maintenance managers [0714]</td>
<td>2,049</td>
<td>Modest</td>
<td>30</td>
<td>205</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-20</td>
<td>215</td>
</tr>
<tr>
<td>Geological, petroleum and mining technologists [2212]</td>
<td>2,254</td>
<td>Modest</td>
<td>135</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-160</td>
<td>270</td>
</tr>
<tr>
<td>Geologists and geophysicists [2113]</td>
<td>3,548</td>
<td>Modest</td>
<td>160</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-245</td>
<td>380</td>
</tr>
<tr>
<td>Occupation [NOC] [cont.]</td>
<td>2016 Estimated Employment</td>
<td>Scenario</td>
<td>Expansion Demand</td>
<td>Replacement Demand</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------</td>
<td>----------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2017 (a)</td>
<td>2018–2021 (b)</td>
</tr>
<tr>
<td>Heavy equipment operators (except crane) [7521]</td>
<td>8,563</td>
<td>Modest</td>
<td>225</td>
<td>980</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-120</td>
</tr>
<tr>
<td>Heavy-duty equipment mechanics [7312]</td>
<td>2,860</td>
<td>Modest</td>
<td>70</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-80</td>
</tr>
<tr>
<td>Industrial electricians [7242]</td>
<td>2,121</td>
<td>Modest</td>
<td>65</td>
<td>190</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-80</td>
</tr>
<tr>
<td>Industrial engineering and manufacturing technologists and technicians [2233]</td>
<td>294</td>
<td>Modest</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-10</td>
</tr>
<tr>
<td>Inspectors in public and environmental health and safety [2263]</td>
<td>1,880</td>
<td>Modest</td>
<td>55</td>
<td>115</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-115</td>
</tr>
<tr>
<td>Inspectors, testers and technicians (non-destructive) [2261]</td>
<td>969</td>
<td>Modest</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-45</td>
</tr>
<tr>
<td>Instrumentation engineering technologists [2241]</td>
<td>804</td>
<td>Modest</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-30</td>
</tr>
<tr>
<td>Instrumentation technicians [2243]</td>
<td>1,711</td>
<td>Modest</td>
<td>20</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-30</td>
</tr>
<tr>
<td>Insulators [7293]</td>
<td>360</td>
<td>Modest</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-20</td>
</tr>
<tr>
<td>Machinists and machining and tooling inspectors [7231]</td>
<td>644</td>
<td>Modest</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-45</td>
</tr>
<tr>
<td>Managers in natural resources production, drilling and well servicing [0811]</td>
<td>5,074</td>
<td>Modest</td>
<td>260</td>
<td>375</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-410</td>
</tr>
<tr>
<td>Mechanical engineering technologists and technicians [2232]</td>
<td>656</td>
<td>Modest</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-30</td>
</tr>
<tr>
<td>Mechanical engineers [2132]</td>
<td>1,798</td>
<td>Modest</td>
<td>+0</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-90</td>
</tr>
<tr>
<td>Millwrights [7311]</td>
<td>4,463</td>
<td>Modest</td>
<td>55</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Delayed</td>
<td>-200</td>
</tr>
<tr>
<td>Occupation [NOC] [cont.]</td>
<td>2016 Estimated Employment</td>
<td>Scenario</td>
<td>Expansion Demand</td>
<td>Replacement Demand</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------</td>
<td>----------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2017 (a)</td>
<td>2018–2021 (b)</td>
<td>Total (a+b)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td>980</td>
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<td>Purchasing managers (0113)</td>
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<td></td>
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### Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)

<table>
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<tr>
<th>Occupation [NOC] [cont.]</th>
<th>2016 Estimated Employment</th>
<th>Scenario</th>
<th>Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
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<td>Shippers and receivers (1521)</td>
<td>554</td>
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<td>Steamfitters and pipefitters (7252)</td>
<td>2,239</td>
<td>Modest</td>
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<td>130</td>
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<tr>
<td>Supervisors and contractors, heavy equipment operator crews (0732)</td>
<td>1,206</td>
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<td>25</td>
<td>55</td>
<td>80</td>
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<td>Supervisors and contractors, oil and gas drilling and services (8222)</td>
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<td>Supervisors, petroleum, gas and chemical processing and utilities (9212)</td>
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<td>80</td>
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<td>Supervisors, supply chain, tracking and scheduling co-ordination occupations (1215)</td>
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<td>25</td>
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<td>Truck drivers (7511)</td>
<td>3,948</td>
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<td>240</td>
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<td>Welders (7237)</td>
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<td>Other occupations</td>
<td>61,222</td>
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<td>1,610</td>
<td>3,120</td>
<td>4,730</td>
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<td>-3,885</td>
<td>4,720</td>
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Notes: Numbers may not add up due to rounding. As noted in the report, not all replacement demand will be filled and may be dependent on the occupation or the circumstance. Refer to detailed spreadsheets for year-over-year numbers.
## Appendix 3: Oil and Gas Services Labour Demand to 2021, by Occupation

<table>
<thead>
<tr>
<th>Occupation [NOC]</th>
<th>2016 Estimated Employment</th>
<th>Scenario</th>
<th>Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>2017 (a)</td>
<td>2018-2021 (b)</td>
<td>Total (a+b)</td>
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<td>Total oil and gas services sector</td>
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<td>3,800</td>
<td>2,800</td>
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<td>Chemical engineers [2134]</td>
<td>295</td>
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<td>5</td>
<td>10</td>
<td>10</td>
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<tr>
<td></td>
<td></td>
<td>Delayed</td>
<td>-25</td>
<td>15</td>
<td>-10</td>
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<tr>
<td>Chemical technologists and technicians [2211]</td>
<td>250</td>
<td>Modest</td>
<td>5</td>
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<td>10</td>
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<td></td>
<td></td>
<td>Delayed</td>
<td>-20</td>
<td>15</td>
<td>-5</td>
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<tr>
<td>Civil engineering technologists and technicians [2231]</td>
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<td></td>
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<td>0</td>
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<td>Civil engineers [2131]</td>
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<td>0</td>
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<td></td>
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<td>Delayed</td>
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<td>5</td>
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<td>Delayed</td>
<td>-25</td>
<td>10</td>
<td>-10</td>
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<td>Crane operators [7371]</td>
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<td>15</td>
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<td>Drafting technologists and technicians [2253]</td>
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<td>-170</td>
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<td>Facility operation and maintenance managers [0714]</td>
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<td>-10</td>
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<td>Geological, petroleum and mining technologists [2212]</td>
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<td>5</td>
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<td>Delayed</td>
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<td>10</td>
<td>-10</td>
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<td>Occupation</td>
<td>2016 Estimated Employment</td>
<td>Expansion Demand</td>
<td>Replacement Demand</td>
<td>Net Hiring Requirements</td>
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<td>------------------------------------------------</td>
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<td>--------------------</td>
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<tr>
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<td>2017 (a)</td>
<td>2018–2021 (b)</td>
<td>Total (a+b)</td>
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<td>60</td>
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<td>Instrumentation engineering technologists [2241]</td>
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<td>Instrumentation technicians [2243]</td>
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<td>Delayed -65</td>
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<td>Managers in natural resources production, drilling and well servicing [0811]</td>
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Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)
<table>
<thead>
<tr>
<th>Occupation [NOC] (cont.)</th>
<th>2016 Estimated Employment</th>
<th>Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
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<tr>
<td></td>
<td>2017 (a)</td>
<td>2018–2021 (b)</td>
<td>Total (a+b)</td>
<td>2017–2021 (c)</td>
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<td>Delayed -10, -5, -15</td>
<td>5, -5</td>
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<tr>
<td>Natural and applied science policy researchers, consultants and program officers [4161]</td>
<td>1,275</td>
<td>Modest 65, 40, 100</td>
<td>170, 270</td>
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<td>Delayed -115, 100, -15</td>
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<tr>
<td>Oil and gas drilling, servicing and related labourers [8615]</td>
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<td>Delayed -195, 480, 290</td>
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<td>Oil and gas well drillers, servicers, testers and related workers [8232]</td>
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<td>Oil and gas well drilling workers and service operators [8412]</td>
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<td>Petroleum engineers [2145]</td>
<td>460</td>
<td>Modest -5, 10, 5</td>
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<td>Other occupations</td>
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Notes: Numbers may not add up due to rounding. As noted in the report, not all replacement demand will be filled and may be dependent on the occupation or the circumstance. Refer to detailed spreadsheets for year-over-year numbers.
## Appendix 4: Conventional E&P Labour Demand to 2021, by Occupation

<table>
<thead>
<tr>
<th>Occupation (NOC)</th>
<th>2016 Estimated Employment</th>
<th>Scenario</th>
<th>Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
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<td><strong>Total conventional E&amp;P sector</strong></td>
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<td>4,900</td>
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<td>2017–2021</td>
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<td>6,700</td>
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<td><strong>Chemical technologists and technicians</strong> (2211)</td>
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<td>65</td>
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<td><strong>Geological, petroleum and mining technologists</strong> (2212)</td>
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Labour Market Outlook 2017 to 2021 for Canada’s Oil and Gas Industry (March 2017)
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<td>Occupation [NOC] (cont.)</td>
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<td>2018–2021 (b)</td>
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<td>Net Hiring Requirements</td>
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<td>2018–2021</td>
<td>Total (a+b)</td>
<td>2017–2021 (a+b+c)</td>
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<td></td>
<td>[a]</td>
<td>[b]</td>
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<td>175</td>
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<td>Other occupations</td>
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<td>2,370</td>
<td>2,725</td>
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<td>2,625</td>
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Notes: Numbers may not add up due to rounding. As noted in the report, not all replacement demand will be filled and may be dependent on the occupation or the circumstance. Refer to detailed spreadsheets for year-over-year numbers.
### Appendix 5: Oil Sands Labour Demand to 2021, by Occupation

<table>
<thead>
<tr>
<th>Occupation [NOC]</th>
<th>2016 Estimated Employment</th>
<th>Expansion Demand 2017 (a)</th>
<th>2018–2021 (b)</th>
<th>Total (a+b)</th>
<th>Replacement Demand 2017–2021 (c)</th>
<th>Net Hiring Requirements 2017–2021 (a+b+c)</th>
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<td><strong>Total oil sands sector</strong></td>
<td>28,900</td>
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<td>20</td>
<td>-5</td>
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<td>310</td>
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<td>Electrical/instrumentation engineers [2133]</td>
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<td>Replacement Demand</td>
<td>Net Hiring Requirements</td>
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<td>2018–2021 (b)</td>
<td>Total (a+b)</td>
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<td>2017–2021 (a+b+c)</td>
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Notes: Numbers may not add up due to rounding. As noted in the report, not all replacement demand will be filled and may be dependent on the occupation or the circumstance. Refer to detailed spreadsheets for year-over-year numbers.
### Appendix 6: Pipelines Labour Demand to 2021, by Occupation

<table>
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<tr>
<th>Occupation [NOC]</th>
<th>2016 Estimated Employment</th>
<th>Scenario</th>
<th>Expansion Demand</th>
<th>Replacement Demand</th>
<th>Net Hiring Requirements</th>
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<td>Net Hiring Requirements</td>
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Notes: Numbers may not add up due to rounding. As noted in the report, not all replacement demand will be filled and may be dependent on the occupation or the circumstance. Refer to detailed spreadsheets for year-over-year numbers.
### Appendix 7: Projected Unemployment Rates to 2021, Total Industry and by Occupation

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<th>Balanced Unemployment Rate (%)</th>
<th>Scenario</th>
<th>Projected Unemployment Rate (%)</th>
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<td>Power engineers and power systems operators (9241)</td>
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<td>Purchasing agents and officers including landmen (1225)</td>
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<td>Purchasing and inventory control workers (1524)</td>
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### Balanced Unemployment Rate (%)

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<td><strong>Shippers and receivers (1521)</strong></td>
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<td><strong>Steamfitters and pipelayers (7252)</strong></td>
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<td><strong>Supervisors, supply chain, tracking and scheduling co-ordination occupations (1215)</strong></td>
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**Note:** Labour supply/demand gaps are assessed by comparing the projected unemployment rates with what is considered to be the balanced unemployment rate for the occupation or industry overall. A labour surplus is assumed if the projected unemployment rate is above the balanced rate. Conversely, a labour shortage is expected if the unemployment rate falls below the balanced rate. For the total oil and gas industry, the balanced unemployment rate is determined to be 6%. The balanced rate differs for each occupation and tends to be higher than 6% if the occupation is highly transferable and/or has a high degree of movement from job-to-job, such as field workers and trades occupations.
Appendix 8: 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 unemployment rate matches the balanced rate.

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

**Capital expenditures (CAPEX):** Funds used by a company to acquire or upgrade physical assets such as property, industrial buildings or equipment. It is often used to undertake new projects or investments.

**Conventional exploration and production (E&P) sub-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.

**Employment:** The number of workers required to support the activity levels in a given year (direct employment only).

**Expansion demand:** This is the projected change in the number of workers required to support industry activity levels.

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

**In situ:** Latin, meaning “in place.”

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

**Labour force:** Labour pool available in an industry and/or sector.

**Labour shortage:** Unemployment rate falls below the balanced rate.

**Labour supply:** Availability of suitable workers in a labour market.

**Labour surplus:** Unemployment rate is above the balanced rate.

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

**National Occupational Classification (NOC):** Developed and updated in partnership with Statistics Canada, the NOC provides a standardized language for describing the work performed by Canadians in the labour market.

**Net hiring requirements:** Sum of job openings created due to expansion and replacement demand.

**Offshore:** 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 sub-sector:** Contracted exploration, extraction and production services to the oil sands and non-oil sands E&P sectors and includes the following:
- Drilling and completion services, including drilling and service rig activities
- Geophysical services (also known as seismic) including surveying, permitting and reclamation, line construction and data acquisition
- Petroleum services pertaining to oilfield services including but not limited to acidizing wells, cementing and perforating well casings, well testing and servicing, pumping, and oil well logging

**Oil sands sub-sector:** Sector of the petroleum industry involved in the extraction and upgrading of bitumen.

**Operating expenditures (OPEX):** A category of expenditure that a business incurs as a result of performing its normal business operations.

**Petroleum (or oil and gas) industry:** Global processes of exploration extraction, refining, transporting and marketing petroleum products.

**Pipelines sub-sector:** Petroleum industry sector responsible for mainline transmission for transporting daily crude oil and natural gas production.

**Replacement demand:** See "age-related attrition”.

**Retention:** Activities based around keeping or retaining workers within a company, organization or 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 that involves two horizontal wellbores, one above the other. Steam is injected into the upper wellbore and softened bitumen is recovered from the lower wellbore.

**Sub-sector:** Subset of an industry.

**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 hydropyrocracking.

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

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PetroLMI specializes in providing petroleum labour market data, analysis and insights, as well as occupation profiles and other resources for workforce and career planning.

With the support of industry, PetroLMI has developed the Careers in Oil + Gas website to provide its resources and key industry information to those in workforce planning or who are planning and pursuing careers in the oil and gas industry.