



Petroleum
Human Resources
Council of Canada

Conseil canadien des
ressources humaines
de l'industrie du pétrole



Petroleum Labour Market Information

The Decade Ahead:

Labour Market Projections & Analysis for
Saskatchewan's Oil and Gas Industry to 2020

May 2011



Canada



Government of
Saskatchewan

Funded in part by the Government of Canada's
Sector Council Program and Province of Saskatchewan.

Copyright © Petroleum Human Resources Council of Canada 2011

All rights reserved. The use of any part of this document without the prior written permission of the Petroleum Human Resources Council of Canada is an infringement of copyright law.

The information and projections contained herein have been prepared with information sources the Petroleum Human Resources Council of Canada believes to be reliable. This document has been published on the basis that the Petroleum HR Council shall not be responsible for any financial or other losses or damages of any nature whatsoever arising from or otherwise relating to any use of this document.

The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Governments of Canada and Saskatchewan.

For more information, contact:

Petroleum Human Resources Council of Canada
Phone: 403-516-8100
Fax: 403-516-8171
Email: info@petrohrsc.ca
www.petrohrsc.ca

Published May 2011

ACKNOWLEDGEMENTS

The Petroleum Human Resources Council of Canada (Petroleum HR Council) would like to acknowledge its funding partners who contributed to the production of this report:

- Government of Canada's Sector Council Program
- Province of Saskatchewan's Ministry of Advanced Education, Employment and Immigration
- Canadian Association of Petroleum Producers

The Petroleum HR Council is also grateful to the following industry associations and companies that have contributed specific information to the completion of this report:

- Canadian Association of Oilwell Drilling Contractors
- Canadian Association of Petroleum Producers
- Canadian Energy Pipeline Association
- Canadian Natural Resources Ltd.
- Cenovus Energy Inc.
- ConocoPhillips Canada
- Enbridge Inc.
- Encana Corporation
- Enerplus Corporation
- Ensign Energy Services Inc.

- Halliburton
- Imperial Oil Ltd.
- Nabors Canada
- Nexen Inc.
- Petroleum Services Association of Canada
- Precision Drilling Corporation
- Sanjel Corporation
- Schlumberger Canada
- Suncor Energy Inc.
- Talisman Energy Inc.
- Total E&P Canada Ltd.
- Trinidad Drilling Ltd.

The Petroleum HR Council would also like to acknowledge the generous time, expertise and support of the Labour Market Information Steering Committee members.

Last but not least, thank you to the consultants involved in producing this study: ARC Financial Corporation, Centre for Spatial Economics, Creative Links International Inc. and Red Queen Creative Group.

THE DECADE AHEAD: LABOUR MARKET PROJECTIONS & ANALYSIS FOR CANADA'S OIL AND GAS INDUSTRY TO 2020

TABLE OF CONTENTS

INTRODUCTION.....	5
EXECUTIVE SUMMARY	6
OVERVIEW OF MODEL AND KEY ASSUMPTIONS FOR SASKATCHEWAN OIL AND GAS OUTLOOK.....	8
<i>SCENARIO ASSUMPTIONS</i>	10
OVERVIEW OF OIL AND GAS INDUSTRY IN SASKATCHEWAN.....	12
<i>CURRENT INDUSTRY EMPLOYMENT</i>	12
SASKATCHEWAN INDUSTRY WORKFORCE CONSIDERATIONS	18
APPENDIX 1: CORE OCCUPATIONS.....	19
APPENDIX 2: HIRING REQUIREMENTS FOR SASKATCHEWAN, BY OCCUPATION.....	26
APPENDIX 3: GLOSSARY OF TERMS	29

INTRODUCTION

The petroleum industry, worldwide and in Canada, is recovering from a widespread economic downturn. Canada's oil and gas industry is already experiencing challenges finding workers – and this will continue if not worsen over the next decade.

Up-to-date and accurate labour market information (LMI) helps stakeholders develop effective workforce strategies. In 2006/2007, skills shortages had a significant impact on Canada's petroleum industry. Despite a short reprieve from these labour market concerns due to the recent economic downturn, workforce demographics will continue to drive the need for human resource strategies to be incorporated into day-to-day and strategic business decisions.

The Petroleum Human Resources Council of Canada (Petroleum HR Council) works with many partners to develop information, strategies and solutions to help Canada's oil and gas industry create a sustainable, skilled and productive workforce.

Petroleum-specific LMI developed by the Petroleum HR Council helps:

- Companies plan successful retention and recruitment strategies;
- Governments make policy and program decisions including immigration strategies, labour adjustment programs and skills and training strategies;
- Professional associations promote their professions and support their members;
- Education and training institutions plan for program content, enrollment and funding;
- Career practitioners and guidance counsellors make career recommendations; and
- Job seekers plan their careers.

The Petroleum HR Council currently produces three types of LMI:

- **Short-term HR Trends:** With data gathered through an online survey of petroleum companies and released twice a year, *Short-term HR Trends* provides a timely snapshot of labour market conditions within the industry. Specific information gathered includes companies' current and planned recruitment practices, in-demand jobs, locations they are hiring for, and workforce trends.
- **Situational Analysis:** Produced every two years, the situational analysis looks at business, regulatory, social and technological trends and their impact on the petroleum workforce.¹
- **Labour Market Projections & Analysis:** Uses industry activity scenarios to develop labour market outlooks for industry total, core occupations, key provinces and petroleum sectors. The analysis identifies key labour supply/demand risks and critical human resources issues to inform effective strategies. Labour market projections and analysis are produced annually.

The purpose of this report is to provide labour market projections and analysis for Saskatchewan's oil and gas industry to 2020, identify labour supply/ demand risks, and recommend workforce strategies

¹ Situational Analysis and Q3/Q4 2010 Short-term HR Trends Report can be found at www.petrohrsc.ca.

for stakeholder consideration. This report provides a range of labour market projections for Saskatchewan based on two industry activity scenarios²:

- A **low scenario**, where low oil and gas prices persist and do not encourage capital investment.
- A **growth scenario** where capital investment is encouraged and growth occurs in both oil and gas-related activity.

Saskatchewan-specific projections were generated in October 2010, validated with industry in December 2010, and presented to provincial stakeholders in February 2011. The next section provides an overview of the model and key assumptions applicable to the Saskatchewan oil and gas outlook.

The Decade Ahead: Labour Market Projections and Analysis for Canada's Oil and Gas Industry to 2020 full report is available for download on the Petroleum HR Council's website (www.petrohrsc.ca).

EXECUTIVE SUMMARY

Saskatchewan is Canada's second largest oil producer and third largest natural gas producer and as a result, has the third largest petroleum workforce in the country. The Petroleum HR Council estimates that for 2009, the oil and gas industry's actual capital and operating expenditures in Saskatchewan generated employment for 17,804 workers. Out of this number, 60% of the work (or 10,657 positions) are estimated to be located in the province. Over 50% of this workforce is employed in the Services sector.

Saskatchewan's oil and gas industry currently faces challenges in attracting and retaining workers in hard-to-recruit locations. This is compounded by competition for talent from other resource-based industries such as mining and forestry. These challenges will persist, if not increase over the next decade.

Similar to the rest of Canada, the oil and gas industry in Saskatchewan will experience significant attrition due to retirements and natural deaths, creating replacement demand. It is projected that in the low scenario, net hiring for Saskatchewan-based employment is 1,500 positions, driven by replacement demand. In the growth scenario, net hiring is over 6,600 positions of which 62% will be due to new jobs created as a result of industry growth in the province.

In the growth scenario, the following are the top 10 Saskatchewan-based core oil and gas occupations with the greatest hiring requirements over the next decade:

BASED ON NUMBER OF POSITIONS	BASED ON % CHANGE FROM 2009
<ul style="list-style-type: none"> • Oil and gas drilling and service field workers (1,756) • Supervisors, oil and gas drilling and service (577) 	<ul style="list-style-type: none"> • Drilling coordinators/production managers (+100%) • Geologists and geophysicists (+99%) • Petroleum/mining/geological engineering

² A growth oil/low gas scenario has also been developed utilizing growth scenario assumptions for oil sands labour market projections and low scenario assumptions for other sectors. This scenario is not applicable for the Saskatchewan oil and gas outlook and is therefore excluded in this report.

BASED ON NUMBER OF POSITIONS	BASED ON % CHANGE FROM 2009
<ul style="list-style-type: none"> • Operators (steam and non-steam) (493) • Truck drivers (464) • Heavy equipment operators (343) • Drilling coordinators/production managers (329) • Millwrights and machinists (307) • Welders (208) • Steamfitters and pipefitters (150) • Petroleum/reservoir engineers (147) 	<ul style="list-style-type: none"> technologists (+91%) • Inspectors in public and environmental, health & safety (+90%) • Landmen/purchasing agents (+89%) • Industrial electricians (+86%) • Drafting technologists and technicians (+85%) • Petroleum/reservoir engineers (+84%) • Instrumentation engineering technologists (+82%)

Potential labour supply opportunities for the Saskatchewan industry include:

- Development of the province's labour supply pools including women and Aboriginal Peoples;
- Attraction and effective integration of immigrants in the province;
- Promotion of oil and gas careers to local students in effort to increase the number of high school graduates that pursue opportunities within the industry;
- Promotion of career opportunities within Saskatchewan's oil and gas industry to post-secondary graduates in efforts to retain them in the province; and
- Development of services and infrastructure within local communities to encourage worker relocation and/or support mobile workers.

OVERVIEW OF MODEL AND KEY ASSUMPTIONS FOR SASKATCHEWAN OIL AND GAS OUTLOOK

The Petroleum HR Council's labour market projections are produced using a modelling system developed by [Centre for Spatial Economics \(C4SE\)](#) in consultation with industry. While labour supply projections can only be produced for Canada as whole, labour demand projections for Saskatchewan are available by:

- **Core occupations:** Labour demand projections are developed at the occupational level. The occupations included in this study have been selected in consultation with industry and are deemed to be core to the petroleum industry. They align with the [National Occupational Classifications \(NOCs\)](#) and represent about 63% of petroleum industry employment. Appendix 1 lists these core occupations and maps them to the National Occupational Classifications (or NOCs) and provides common industry job titles for each petroleum sector. The remaining occupations are lumped together under "other occupations."
- **Petroleum industry sectors:**
 - **Exploration and Production (E&P):** activity for conventional and unconventional oil and gas reserves excluding oil sands;
 - **Services:** contracted exploration, extraction and production services to the E&P and Oil sands sectors excluding manufacturing and supply of oil and gas-related equipment and products;
 - **Petroleum services** include well services, oilfield construction and maintenance, production and transportation services;
 - **Drilling and completions services** include drilling and service rigs;
 - **Geophysical services** (also known as seismic) include survey, permitting and reclamation, line construction, drilling and data acquisition; and
 - **Pipeline:** mainline transmission for transporting daily crude oil and natural gas production in Canada.

The Petroleum HR Council's provincial labour demand modelling system helps identify:

- **Hiring based on industry activity:** or expansion demand, is the projected change in employment based on industry activity. Expansion demand may be positive, negative or zero;
- **Hiring based on age-related attrition:** or replacement demand, is the number of positions that will be vacated due to retirements and natural deaths; and
- **Hiring outlook:** total number of positions available due to expansion and replacement demand.

Determining Hiring Based on Industry Activity

To determine Saskatchewan hiring requirements based on industry activity, the model projects an occupation's growth using employment drivers which vary by petroleum sector:

- Exploration and production: E&P capital and operations expenditures.
 - The core occupations represent approximately 56% of E&P's workforce.
- Services: E&P capital and operations expenditures.
 - The core occupations represent approximately 50% of the Services sector workforce.

- Pipelines: Existing pipelines are based on oil and gas production while new pipelines are considered on a case-by-case basis.
 - The core occupations represent approximately 39% of pipeline employment.

Provincial employment drivers were developed by averaging the five-year E&P capital and operating expenditure for each province. Two sets of employment projections are available for Saskatchewan's oil and gas industry:

- **Employment generated by capital and operating expenditures:** includes work that is located in Saskatchewan as well as head office which are most likely based in Calgary; and
- **Employment in the province (place of work):** focuses on employment that is associated with actual work in the province and have been calculated using field versus head office work location ratios by occupation gathered from E&P and service companies.

The employment projections in this report are highly dependent on the employment drivers being realized (i.e.: expenditures spent or production coming on stream). However, it is important to note the hiring of workers often precedes the employment driver. If the labour market is particularly tight and there are labour shortages, the company may start hiring one to two years in advance of when additional production is scheduled to come on stream. Consequently, stakeholders should be mindful of the timing difference that can occur between actual hiring activity and the projected year-over-year employment resulting from this study.

Determining Hiring Based on Age-related Attrition

Replacement demand for the upstream petroleum industry is calculated from the labour supply projections as retirements and natural deaths are a component of labour force change. Replacement demand for the industry is primarily due to workers retiring; however, as the petroleum industry workforce ages, a certain amount of natural death also occurs amongst employees.

- The number of natural deaths for an occupation in an age group is modeled as the product of an age-specific death rate and the number of people in the labour force of that age group:
 - Deaths = Death Rate multiplied by Labour Force.
 - The death rates are based on those published by Statistics Canada.
- Retirements are modeled as a product of a retirement rate for an age group and the number of people in the labour force of that age:
 - Retirements = Retirement Rate multiplied by Labour Force.
 - The age groups for retirements start at the group 45-54. The retirement rates are computed initially from data on labour force participation rates by age groups for the economy as a whole. They can be adjusted by the Petroleum HR Council's model across occupations.

The projected age-related attrition rates differ for each scenario with a higher attrition rate estimated/projected in the growth scenario. This is because in the growth scenario, where there is economic and employment growth in the industry, a greater number of mature workers are attracted and represented into the petroleum workforce which in turn impacts the age demographic make-up of the workforce.

Age-related attrition for Saskatchewan's oil and gas workforce is estimated by applying the percentage of age-related attrition for each occupation during the projections period to Saskatchewan-based employment.

SCENARIO ASSUMPTIONS

In a commodity-based industry such as oil and gas, price is the primary predictor of investment and this drives overall activity, but it is volatile. To accommodate the fluctuations in oil and gas pricing and industry investment, industry activity scenarios have been developed to generate the updated labour market projections and analysis.

Employment Driver Data Sources and Scenario Development

For the 2010-2020 employment projections, two oil and gas price projections, capital and operating expenditure and production forecasts³ became the foundation for the industry activity scenarios.

Once production and price forecasts have been determined, **conventional capital expenditures** are determined by:

- Calculating cash flow using forecasted price and forecasted production, then
- Multiplying cash flow by a reinvestment ratio.

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

In 2010, the Growth Scenario operating costs are escalated between 3 and 4.5% per year for the forecast period. In the Low Price Scenario, operating costs are escalated at between 1 – 2.5% per year.

OVERVIEW OF EMPLOYMENT DRIVER ASSUMPTIONS

LOW SCENARIO	GROWTH SCENARIO
Oil and Gas Prices	
Oil price stabilizes at or below \$70/bbl.	Oil price of \$90-\$115/bbl is optimal for aggressive but sustainable growth.
Current natural gas price persists and stays under \$4/mcf until 2013. From 2013 to 2020, gas prices average at \$4.44/mcf.	Rebalancing of supply/demand for natural gas occurs and therefore: <ul style="list-style-type: none"> • Price increases to \$6 mcf or higher in the medium-term (2012).

³ The [Canadian Association of Petroleum Producers](#) (CAPP) is the information source for oil and gas production forecasts as well as actual capital and operations expenditures. CAPP's *Crude Oil Forecast and Market Outlook* is released in May/June of each year. Their natural gas production forecast is updated periodically through the year. Exploration and production actual capital and operations expenditure information is available from CAPP in July/August of each year. [ARC Financial Corporation](#) was hired to develop price scenarios and conventional capital and operations expenditure forecasts for each scenario. ARC Financial used their expertise to determine reasonable oil and gas prices that would result in the oil and gas production forecast as reported by CAPP.

LOW SCENARIO	GROWTH SCENARIO
	<ul style="list-style-type: none"> Aligned with international price (NBP) by 2015.
Conventional Capital and Operating Expenditures	
<p>Capex remains relatively flat for 2010-2020.</p> <ul style="list-style-type: none"> Reinvestment ratio falls below 10-year average to 55-60%. 	<p>Capex returns to 2006 levels around 2014.</p> <ul style="list-style-type: none"> Oil and gas prices encourage increased capital investment to 60-70%. Higher than the 10-year average.

Industry Activity Scenarios for Saskatchewan

- 1. Low Scenario:** utilizes low scenario assumptions to determine labour market projections for all sectors. Low oil and gas prices do not encourage industry investment or growth and E&P investment in conventional/unconventional oil and gas falls below the 10-year average reinvestment ratio.
- 2. Growth Scenario:** utilizes growth scenario assumptions to determine labour market projections for all sectors. Both oil and gas prices encourage expansion across all petroleum industry sectors and E&P capital reinvestment rises above the 10-year average to 60-70%.

OVERVIEW OF OIL AND GAS INDUSTRY IN SASKATCHEWAN

Saskatchewan is Canada's second largest oil producer and third largest natural gas producer. The province is rich with both light and heavy crude oil deposits and current oil prices have encouraged drilling. The northwestern region of the province also has oil sands deposits that are not being developed at this time and are not expected to produce before 2020. Saskatchewan is also home to the Petroleum Technology Research Centre that is focused on enhanced oil recovery as well as carbon capture and storage technologies.

Land sales, a leading indicator of industry activity, have been strong in the province throughout 2010 - valued close to \$463 million in 2010, compared to only \$118 million in 2009.⁴ Higher oil prices, increased investment through land sales, and the increased use of horizontal and multi-fracking drilling technologies to enhance oil recovery have all made a positive impact on oil-related activity in Saskatchewan.

Saskatchewan has Canada's third largest petroleum workforce with close to 60% of its oil and gas workforce employed in the Services sector. Many of the Saskatchewan-based services companies are small and the need to hire for multiple positions or multiple vacancies puts pressure on all staff. In addition, the province's other natural resource industries, such as mining and forestry, compete with the petroleum industry for workers.

Saskatchewan oil and gas employment saw steady growth between 2006 and 2008 as oil prices and industry activity were high. Royalty changes in Alberta were also a catalyst for increased investment in Saskatchewan. Similar to other provinces, Saskatchewan endured job losses in the industry during the economic downturn as oil prices declined significantly.

The province has a long history of supplying workers to the Canadian oil and gas industry. Saskatchewan's post-secondary institutions provide training that aligns with industry's needs. Its agricultural background has traditionally produced workers with the strong mechanical aptitude and willingness to work outdoors, desired attributes of the Services sector. Unfortunately, this labour supply pool is shrinking. Saskatchewan also has a growing population of Aboriginal Peoples, which is a labour supply opportunity for the oil and gas industry.

CURRENT INDUSTRY EMPLOYMENT

Saskatchewan is one of the Canadian petroleum industry's key operating locations. In 2009, the province accounted for 13% of the Exploration and production (E&P) sector's capital and operating expenditures that generated work for over 10% of the total Canadian petroleum workforce. This includes workers located in Saskatchewan as well as head office staff who are most likely based in Calgary.

Like other key field locations, Saskatchewan's oil and gas workforce is primarily employed within the Services sector as the focus is on executing exploration and production plans.

The following table illustrates employment generated by capital and operating expenditures in Saskatchewan as well as estimated employment in the province for 2009.⁵ It is estimated that the oil

⁴ Based on land sales statistics from www.er.gov.sk.ca/oilgas.

⁵ Estimates have been calculated using field versus head office work location ratios by occupation, which have been gathered from E&P and service companies.

and gas industry's 2009 capital and operating expenditures in the province generated employment for 17,804 workers with 60% of the work (or 10,657 positions) occurring in the province.

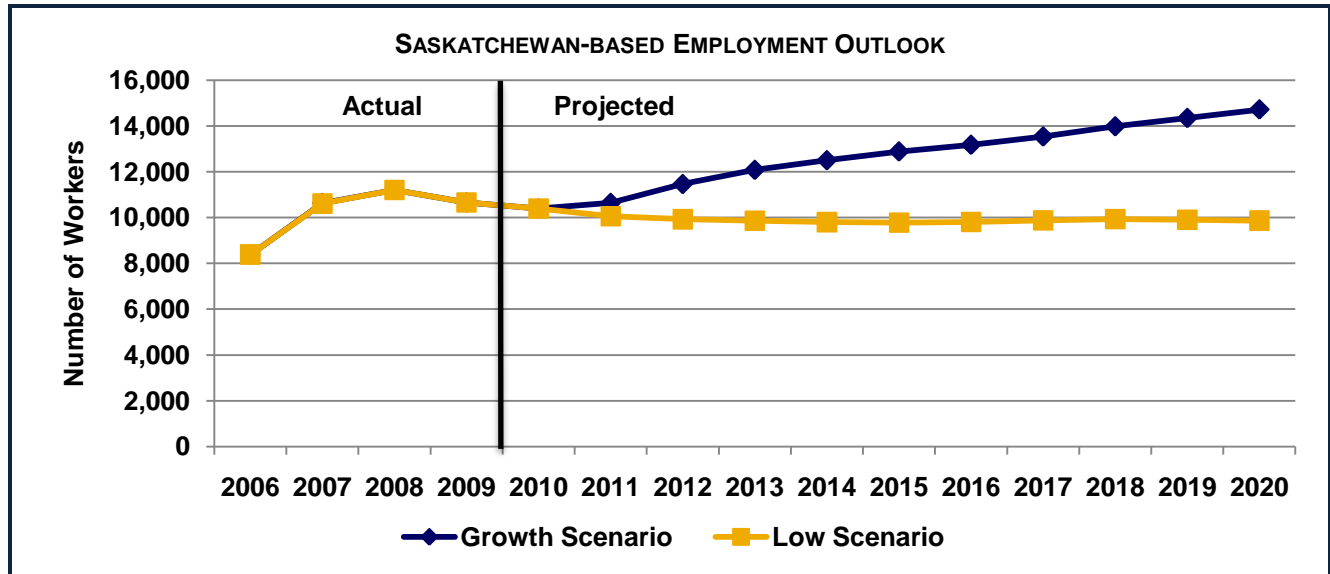
SECTOR	NUMBER OF PERSONS EMPLOYED (2009 ESTIMATED)		
	CANADA	SASKATCHEWAN	
		GENERATED BY CAPEX/OPEX	EMPLOYED IN THE PROVINCE (% OF GENERATED)
Exploration & Production (E&P)	66,099	8,085	3,424 (42%)
Oil Sands	12,269	n/a	n/a
Services	80,410	8,533	6,047 (71%)
Pipeline	8,900	1,186	1,186 (100%)
Offshore	3,166	n/a	n/a
Total Petroleum Industry	170,844	17,804	10,657 (60%)

SASKATCHEWAN OIL AND GAS OUTLOOK TO 2020

The focus of the Saskatchewan oil and gas outlook will be on workers employed in Saskatchewan. Detailed data tables for Saskatchewan projections can be found in Appendix 2.

Saskatchewan Hiring Due to Industry Activity

The following chart provides the Saskatchewan-based employment outlook which is used to calculate the hiring requirements as a result of industry activity.

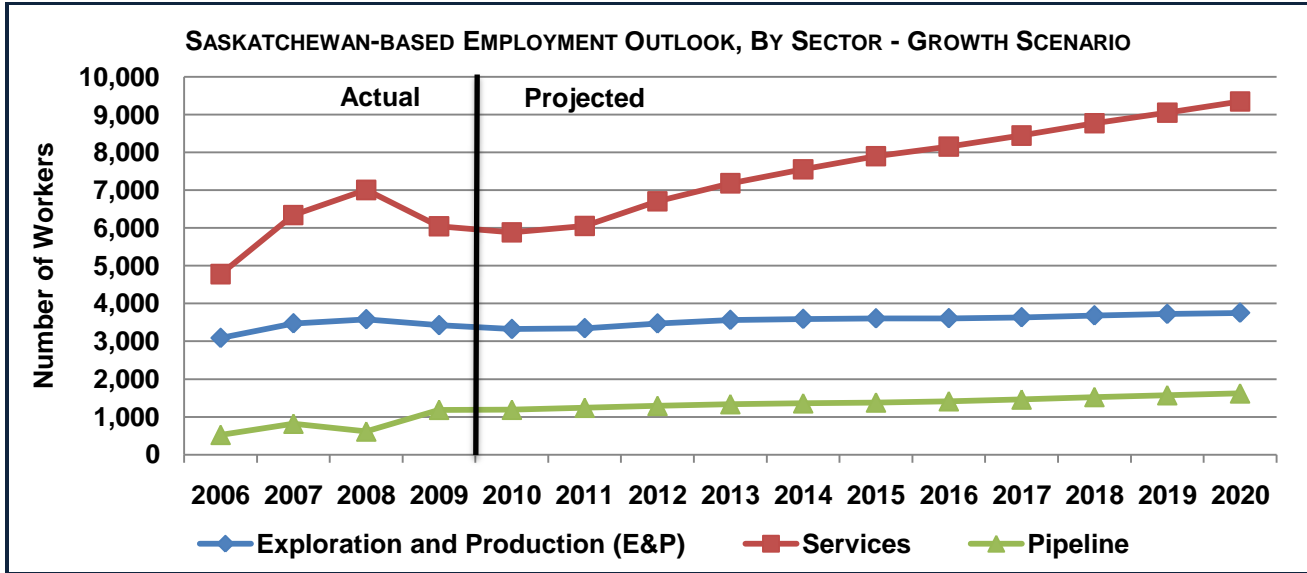


Low Scenario

In the low scenario, where low oil and gas prices do not encourage additional industry investment, Saskatchewan-based employment is projected to decrease by approximately 7% or 800 fewer jobs over the next decade.

Job losses and gains within the Saskatchewan industry under the low scenario are not equal across the sectors:

- Decreased investment results in greater job losses within the E&P sector than the Services or Pipeline sectors. The E&P sector is projected to lose approximately 575 jobs.
- The Services sector involved in field operations is projected to lose under 300 jobs.
- The Pipeline sector is projected to gain approximately 50 jobs.

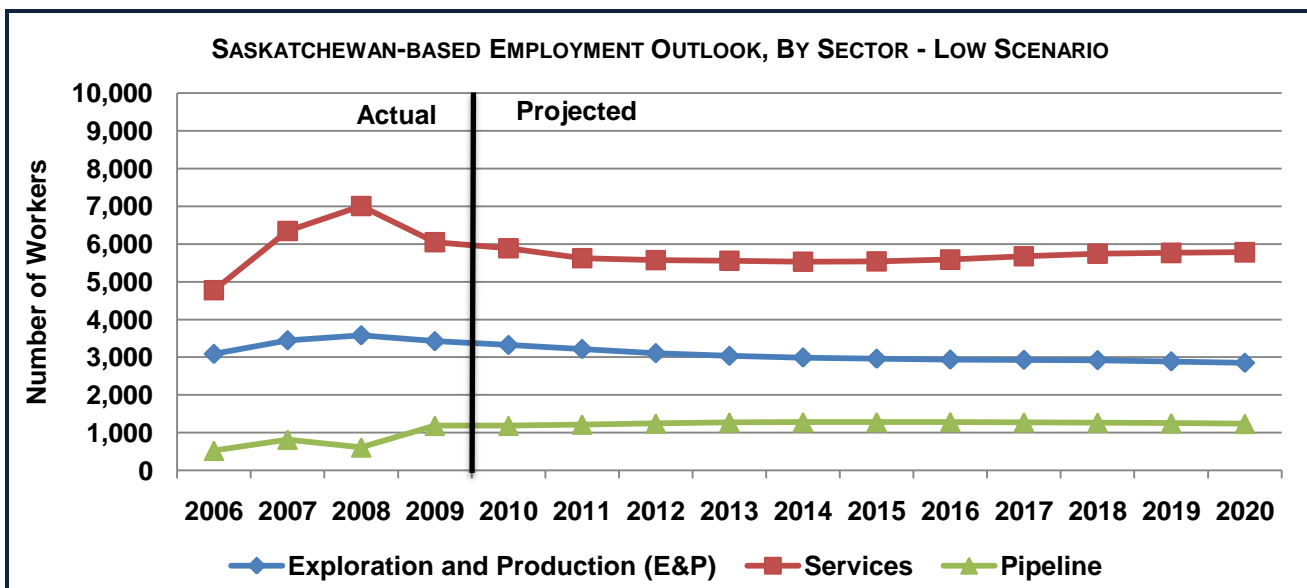


Growth Scenario

In the growth scenario, oil and gas prices encourage expanded activity across all petroleum industry sectors. The number of jobs located in Saskatchewan is expected to expand by approximately 4,000 or 38% of the 2009 employment level.

In the growth scenario, increased industry investment in Saskatchewan will result in the addition of employment across all sectors.

- The E&P sector is projected to expand by approximately 300 jobs.
- The Services sector will gain approximately 3,300 jobs.
- The pipeline workforce is projected to expand by around 450 jobs.



SUMMARY OF INDUSTRY HIRING BY SECTOR DUE TO INDUSTRY ACTIVITY IN SASKATCHEWAN

SECTOR	SASKATCHEWAN-BASED EMPLOYMENT (2009)	SASKATCHEWAN HIRING DUE TO INDUSTRY ACTIVITY 2010 – 2020 (% OF 2009)	
		LOW SCENARIO	GROWTH SCENARIO
E&P	3,424	-575 (-17%)	330 (+10%)
Services	6,047	-266 (-4%)	3,300 (+55%)
Pipelines	1,186	53 (+4%)	434 (+37%)
Total	10,657	-788 (-7%)	4,064 (+38%)

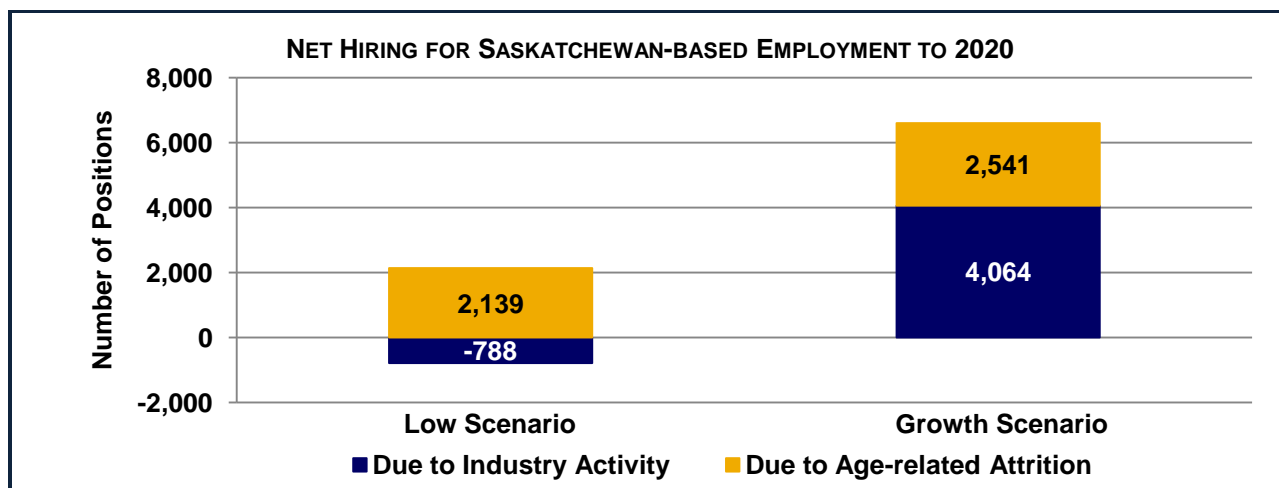
Occupations with the Greatest Increases Due to Industry Activity

The Saskatchewan-based occupations expected to experience the greatest number of increases due to industry activity in the growth scenario include:

- Oil and gas drilling and service field workers;
- Supervisors, oil and gas drilling and service;
- Truck drivers;
- Operators (steam and non-steam);
- Heavy equipment operators;
- Drilling coordinators/production managers;
- Millwrights and machinists;
- Welders;
- Steamfitters and pipefitters;
- Petroleum/reservoir engineers;
- Industrial electricians;
- Geologists and geophysicists;
- Heavy-duty equipment mechanics;
- Petroleum/mining/geological engineering technologists; and
- Instrumentation technicians.

Net Hiring Requirements for Saskatchewan-based Employment

Net hiring, which is shown in number of positions, is calculated by adding hiring requirements due to industry activity and age-related attrition.⁶ Saskatchewan's oil and gas industry will need to hire workers regardless of scenario. It is important to keep in mind that turnover is not accounted for in the hiring outlook. If a position experiences high turnover, it will likely need to be filled a number of times during the projection period.



⁶ As explained earlier, age-related attrition for Saskatchewan's oil and gas workforce is estimated by applying the percentage of age-related attrition for each occupation during the projections period to Saskatchewan-based employment.

Low Scenario

Despite job losses in the low scenario due to decreased industry activity, the Saskatchewan industry will need to hire for approximately 1,500 positions or 13% of its 2009 workforce, as a result of age-related attrition. The following occupations need to add over 100 new workers over the next decade. This could be a challenge given the industry's current challenges in filling positions in Saskatchewan.

- Operators (steam and non-steam);
- Supervisors, oil and gas drilling and services;
- Oil and gas drilling and services field workers;
- Truck drivers; and
- Drilling coordinators/production managers.

Growth Scenario

In the growth scenario, the industry will need to hire for over 6,600 Saskatchewan-based positions or 62% of the province's 2009 workforce. Hiring requirements are approximately 4,100 positions generated by increased industry activity and over 2,500 positions due to age-related attrition.

A number of occupations are projected to require hiring near or above 80% their 2009 employment including:

- Drilling coordinators/production managers (100% of 2009 employment);
- Geologists and geophysicists (99% of 2009 employment);
- Petroleum/mining/geological engineering technologists (91% of 2009 employment);
- Inspectors in public and environmental health and safety (90% of 2009 employment);
- Landmen/purchasing agents (89% of 2009 employment);
- Industrial electricians (86% of 2009 employment);
- Drafting technologists and technicians (85% of 2009 employment);
- Petroleum/reservoir engineers (84% of 2009 employment);
- Instrumentation engineering technologists (82% of 2009 employment);
- Industrial engineering technologists (82% of 2009 employment); and
- Mechanical engineering technologists (81% of 2009 employment).

SASKATCHEWAN INDUSTRY WORKFORCE CONSIDERATIONS

The current workforce challenges experienced by the Saskatchewan petroleum industry are going to continue:

- Even if Saskatchewan oil and gas employment stays relatively stable over the next decade, as in the low scenario, age-related attrition results in the need to hire for approximately 1,500 new positions. Again, many of the Saskatchewan-based service companies are small and the need to hire for multiple positions or multiple vacancies due to turnover puts pressure on all staff.
- It is anticipated the Saskatchewan oil and gas industry will experience competition for workers from the province's other natural resources industries including mining and forestry.
- Increased industry activity is likely to further strain local housing, infrastructure and services. This could be a deterrent to attracting and retaining workers, which is already a challenge particularly in hard-to-recruit locations.

Potential labour supply opportunities for the Saskatchewan industry include:

- Development of the province's labour supply pools including women and Aboriginal Peoples;
- Promotion of oil and gas careers to local students in effort to increase the number of high school graduates that pursue opportunities within the industry;
- Promotion of career opportunities within Saskatchewan's oil and gas industry to post-secondary graduates in efforts to retain them in the province; and
- Development of services and infrastructure within local communities to encourage worker relocation and/or support mobile workers.

APPENDIX 1: CORE OCCUPATIONS

The following are the core occupations included in this study:

- Chemical Engineering Technologists
- Chemical Engineers
- Civil Engineers
- Crane Operators
- Drafting Technologists and Technicians
- Drilling Coordinators/Production Managers
- Electrical and Electronics Engineering Technologists and Technicians
- Electrical/Instrumentation Engineers
- Environmental Technicians
- Geologists and Geophysicists
- Heavy Equipment Operators
- Heavy-duty Equipment Mechanics
- Industrial Electricians
- Inspectors in Public, Environmental and Occupational Health and Safety
- Instrumentation Engineering Technologists
- Instrumentation Technicians
- Insulators
- Millwrights and Machinists
- Mechanical Engineering Technologists
- Mechanical Engineers
- Mining Engineers
- Oil and Gas Well Drillers, Servicers, Testers and Related Workers, Operators and Labourers
- Operators - Steam and Non-steam Ticket
- Petroleum Engineering Technologists
- Petroleum Engineers
- Production Clerks/Production Accountants
- Project/Cost Control Engineers
- Purchasing Agents/Landmen
- Quality Assurance Analysts
- Steamfitters and Pipefitters
- Supervisors, Oil and Gas Drilling and Service
- Supervisors, Petroleum, Gas and Chemical Processing and Utilities
- Truck Drivers
- Welders

MAPPING OF CORE OCCUPATIONS TO NATIONAL OCCUPATIONAL CLASSIFICATIONS (NOC) AND INDUSTRY JOB TITLES

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
Chemical engineering technologists (2211)	Field technician	n/a	n/a	Chemical engineering technologist, production technologist, reservoir technologist, quality	n/a

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
				assurance analyst	
Chemical engineers (2134)	Field engineer, production operations engineer, production engineer	Drilling engineer, well engineer, production operations engineer, field engineer	n/a	Production engineer, reservoir engineer, reliability engineer, drilling and completions engineer, exploitation engineer	Pipeline engineer, inspection engineer, pipeline integrity engineer
Civil engineers (2131)	n/a	n/a	n/a	Civil engineer	Pipeline engineer, inspection engineer, pipeline integrity engineer
Crane operators (7371)	Crane operator	Crane operator	n/a	n/a	n/a
Drafting technologists & technicians (2253)	Drafting technologist, CAD technologist	n/a	n/a	Drafting technologist, CAD technologist	Pipeline design technologist
Production managers (0811)	Drilling coordinator, production engineer, production manager	Production engineer,	n/a	Drilling coordinator, production engineer, production manager	n/a
Electrical/instrument- ation engineers (2133)	Electrical/instrument- ation engineer	Electrical/instrument- ation engineer	n/a	Electrical/instrument- ation engineer	Electrical/instrument- ation engineer
Environmental technicians (4161)	Environmental technician	Environmental technician	n/a	Environmental technician	Environmental technician
Geologists & geophysicists (2113)	Geologist, geophysicist	Geologist, geophysicist	n/a	Geologist, geophysicist	Geologist, geophysicist
Heavy equipment operators (except crane) (7421)	Heavy equipment operator	Heavy equipment operator	Heavy equipment operator	Heavy equipment operator	Heavy equipment operator
Heavy-duty equipment mechanics (7312)	Heavy duty Mechanic	Heavy duty mechanic	Heavy duty mechanic	Heavy duty mechanic	Heavy duty mechanic

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
Industrial electricians (7242)	Industrial electrician, electrician, electrical technician	Industrial electrician, electrician, electrical technician	n/a	Industrial electrician, electrician, electrical technician	Industrial electrician, electrician, electrical technician
Industrial engineering and manufacturing technologists and technicians (2233)	Industrial engineering technologist, engineering technologist	n/a	n/a	Industrial technician, engineering technologist	SCADA technician
Inspectors in public and environmental health and safety (2263)	Health & safety inspector, EH&S specialist	Health & safety inspector, EH&S specialist	Health & safety inspector, EH&S specialist, OHSE field advisor	Health & safety inspector, EH&S specialist	Health & safety inspector, EH&S specialist
Instrumentation engineering technologists (2241)	Instrumentation technologist, instrumentation technician	Instrumentation technologist	n/a	DCS Specialist, DCS technician, instrumentation technologist/ technician	SCADA design technologist, SCADA technologist
Instrumentation technicians (2243)	Instrumentation technician, Instrumentation mechanic, service technician, field services technician	Instrumentation technician	n/a	DCS Specialist, DCS technician, Instrumentation technologist, Instrumentation technician	SCADA technician
Insulators (7293)	Insulators	Insulators	n/a	Insulators	Insulators
Purchasing agents (1225)	Purchaser, materials coordinator, procurement	Purchaser, materials coordinator, procurement	Purchaser, materials coordinator, procurement	Landman, contract administrator, contract manager, contract specialist	Contract administrator, contract manager, contract specialist
Machinists and machining and tooling inspectors (7231)	Machinist, CNC machinist	Machinist	n/a	Machinist	Machinist

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
Mechanical engineering technologists (2232)	Engineering technician, hydraulic technician	Hydraulic technician	n/a	Reservoir engineering technologist, reservoir technician, mechanical engineering technologist	Mechanical design technologist
Mechanical engineers (2132)	Mechanical engineer, field engineer, production operations engineer, production engineer	Drilling engineer, well engineer, production operations engineer, field engineer	n/a	Mechanical engineer, facilities engineer, production engineer, reservoir engineer, drilling and completions engineer, exploitation engineer	Pipeline Engineer, Inspection engineer, pipeline integrity engineer, facilities engineer, measurement engineer
Millwrights (7311)	Millwright	Millwright	n/a	Millwright	Millwright
Mining engineers (2143)	n/a	n/a	n/a	n/a	n/a
Mining/geological engineering technologists (2212)	Petroleum engineering technologist, engineering technician	Petroleum engineering technologist, field specialist	n/a	Petroleum engineering technologist, reservoir technologist	n/a
Oil and gas drilling, servicing, and related labourers (8615)	Labourer, floorhand, Leasehand	Floorhand, leasehand, roustabout	Seismic worker	n/a	n/a
Oil and gas well drillers, servicers, testers, and related workers (8232)	Cementer helper, fracturing operator trainee, tubing helper, production testing trainee, perforator helper, rigger,	Rig technician	Chainsaw buckler, driller's helper, line crew helper, survey helper	n/a	n/a

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
	snubbing assistant operator, well puller helper, well testing helper, wireline helper/operator trainee, loggers, testers				
Oil and gas well drilling workers and service operators (8412)	Driller, derrickhand, motorhand, production well test operator, snubbing services operator, wireline operator, acidizing operator, pump servicer, power tong/casing operator, cementing operator, coil tubing operator, completion/ service tool operator, drill stem test operator, fishing tool operator, fracturing equipment operator, logging & coring operator, nitrogen operator, swabbing unit operator	Directional driller, measurement while drilling specialist, MWD operators, driller, derrickhand, motorhand, rig technician	Seismic permit agent, GPS surveyor, buried facilities locator, faller, faller tutor, driller, drill push, shooter blaster, observer	n/a	n/a
Operators (9232+7351)	Cementing plant operator, drilling fluids	n/a	n/a	Plant operator, gas plant operator, field	Control room operators, gas control

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
	plant operator			operator, production Operator, battery operator, 1 st , 2 nd , 3 rd and 4 th Class power engineer	operator, compressor Operator, facilities operator, pipeline operator
Petroleum engineers (2145)	Petroleum engineer, field engineer, production operations engineer, production engineer	Drilling engineer, well engineer, production operations engineer, field engineer	n/a	Petroleum engineer, production engineer, reservoir engineer, drilling and completions engineer, exploitation engineer	Petroleum engineer, reservoir engineer
Production clerks (1473)	n/a	n/a	n/a	Production accountant	Production accountants, oil/gas scheduler, pipeline scheduler, measurement technician
Project/cost control engineers (2141)	Project engineer, cost control engineer	Project engineer	n/a	Project engineer, cost control engineer	Project engineer, cost control engineer
Quality assurance analysts (2261)	Quality assurance analyst, mechanical QA, QA/QC inspector, coordinator	n/a	n/a	Quality assurance analyst, NDT technician, NDT analyst	Quality assurance analyst, measurement integrity analyst
Steamfitters and pipefitters (7252)	Steamfitter/pipefitter	Steamfitter/pipefitter	n/a	Steamfitter/pipefitter	Pipefitter
Supervisors, oil and gas drilling and service (8222)	Rig manager, service rig manager, field supervisor	Rig manager, drilling rig manager	Seismic field operations supervisor	n/a	n/a
Supervisors, petroleum, gas and	n/a	n/a	n/a	Supervisor, gas plant facilities manager,	Pipeline supervisor

NOC TITLE & CODE (CENSUS DATA)	SAMPLE PETROLEUM SERVICES JOB TITLE(S)	SAMPLE DRILLING JOB TITLE(S)	SAMPLE GEOPHYSICAL JOB TITLE(S)	SAMPLE E&P JOB TITLE(S)	SAMPLE PIPELINE JOB TITLE(S)
chemical processing and utilities (9212)				operations manager	
Truck drivers (7411)	Truck driver, Class 1, Class 3	Truck driver, Class 1, Class 3	Truck driver, Class 1, Class 3	Truck driver	n/a
Welders (7265)	Welder	Welder	n/a	Welder	Welder

*Note: For the occupational employment projections, Oil and Gas Drilling, Servicing, and Related Labourers (8615), Oil and Gas Well Drillers, Servicers, Testers, and Related Workers (8232), and Drilling Workers and Service Operators (8412) are combined under **Oil and Gas Drilling and Services Field Workers**.*

APPENDIX 2: HIRING REQUIREMENTS FOR SASKATCHEWAN, BY OCCUPATION

HIRING REQUIREMENTS FOR SASKATCHEWAN TO 2020

(In Descending Order based on Net Hiring as a % of 2009 in Growth Scenario)

OCCUPATION	SK-BASED EMPLOYMENT (2009)	LOW SCENARIO			GROWTH SCENARIO		
		HIRING DUE TO:		NET HIRING (% OF 2009)	HIRING DUE TO:		NET HIRING (% OF 2009)
		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION	
Drilling coordinators/ production managers	328	-13	124	111 (34%)	178	151	329 (100%)
Mining engineers	2	0	1	1 (50%)	1	1	2 (100%)
Geologists and geophysicists	132	-6	49	43 (32%)	72	58	130 (99%)
Petroleum/mining/geological engineering technologists	116	-4	33	29 (25%)	65	42	107 (92%)
Inspectors in public and environmental, health & safety	62	-4	22	18 (29%)	30	26	56 (90%)
Landmen/purchasing agents	29	0	10	10 (35%)	14	12	26 (89%)
Drafting technologists and technicians	17	-1	5	4 (23%)	9	6	15 (88%)
Civil engineers	8	0	2	2 (25%)	4	3	7 (88%)
Industrial electricians	148	-7	47	40 (27%)	74	53	127 (86%)
Petroleum/reservoir engineers	176	-6	51	45 (26%)	85	62	147 (84%)
Instrumentation engineering technologists	41	0	12	12 (25%)	20	14	34 (82%)

OCCUPATION	SK-BASED EMPLOYMENT (2009)	LOW SCENARIO			GROWTH SCENARIO		
		HIRING DUE TO:		NET HIRING (% OF 2009)	HIRING DUE TO:		NET HIRING (% OF 2009)
		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION	
Chemical engineering technologists	33	-1	8	7 (21%)	17	10	27 (82%)
Industrial engineering technologists	12	-1	4	3 (27%)	5	5	10 (82%)
Mechanical engineering technologists	21	0	5	5 (24%)	11	6	17 (81%)
Electrical/instrumentation engineers	21	-1	6	5 (24%)	10	7	17 (81%)
Project/cost control engineers	15	1	4	5 (33%)	6	6	12 (80%)
Truck drivers	588	-35	153	118 (20%)	282	182	464 (79%)
Mechanical engineers	53	-1	14	13 (25%)	25	17	42 (79%)
Heavy-duty equipment mechanics	147	-10	43	33 (22%)	65	49	114 (77%)
Crane operators	53	-4	16	12 (23%)	22	19	41 (77%)
Insulators	57	-4	14	10 (18%)	26	17	43 (76%)
Welders	289	-21	69	48 (17%)	127	81	208 (72%)
Chemical engineers	34	0	9	9 (26%)	14	10	24 (71%)
Millwrights and machinists	439	-36	119	83 (19%)	167	140	307 (70%)
Quality assurance analysts	20	-1	6	4 (25%)	7	7	14 (70%)

OCCUPATION	SK-BASED EMPLOYMENT (2009)	LOW SCENARIO			GROWTH SCENARIO		
		HIRING DUE TO:		NET HIRING (% OF 2009)	HIRING DUE TO:		NET HIRING (% OF 2009)
		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION		INDUSTRY ACTIVITY	AGE- RELATED ATTRITION	
Heavy equipment operators	506	-47	142	95 (19%)	186	157	343 (68%)
Environmental technicians	25	-2	6	4 (17%)	10	7	17 (68%)
Steamfitters and pipefitters	232	-20	53	33 (14%)	90	60	150 (65%)
Production clerks/production accountants	23	1	7	8 (34%)	8	7	15 (65%)
Supervisors, oil and gas drilling and service	896	-87	242	155 (17%)	299	278	577 (64%)
Instrumentation technicians	130	-11	33	22 (17%)	41	38	79 (61%)
Supervisors, petroleum and gas processing	140	-20	50	30 (22%)	24	56	80 (57%)
Oil and gas drilling and service field workers	3,276	-283	393	110 (3%)	1,232	524	1,756 (54%)
Operators (steam and non-steam)	957	-117	278	161 (17%)	187	306	493 (52%)
Other occupations	354	-9	110	101 (28%)	156	127	283 (80%)

APPENDIX 3: GLOSSARY OF TERMS

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

Balanced labour market – The point at which the supply of workers meets labour market demand.

Bitumen – A tar-like form of crude oil, often found in oil sand deposits.

Conventional – This refers to the process of recovering petroleum from a well using standard drilling production methods.

Downstream (oil sector) – A 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.

Employee turnover – The ratio of the number of workers that have to be replaced in a given time period to the average number of workers. In this report, employee turnover due to age-related attrition (retirements and deaths) have been taken into account in the industry's hiring requirements. Employee turnover initiated by the employee (i.e. leave for another industry, company) has not been taken into account.

Expansion demand – Hiring due to activity levels.

Exploration and Production (E&P) sector – Activity for conventional and unconventional oil and gas reserves, excluding oil sands.

Fracturing (or Fraccing) – The process involves pumping fluid, sand and chemicals at a high pressure down a well hole to open a previously opened oil and gas deposit vein to access more oil and gas.

Growth oil/low gas scenario – This term refers to the scenario where gas prices remain low and discourage capital investment in gas-related activity, but oil prices and investment increase and encourage oil-related activity and oil sands production growth.

Growth scenario – This term refers to the scenario where capital investment is encouraged and growth occurs in both oil and gas-related activity and oil sands production.

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

In-situ – A technique using steam to recover oil from the sand in oil sands extraction.

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

Net hiring – The net number of positions the petroleum industry will need to hire due to age-related attrition and industry activity in a given scenario.

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

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

Labour shortage – When there is not enough labour supply to meet labour demand.

Labour supply – Availability of suitable workers in a particular labour market.

Labour supply pools – Availability of groups of suitable workers in a particular labour market.

Labour surplus – When there is more labour supply available than is required to meet labour demand.

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

Load-leveling – In this report, this term refers to the rearranging of demand for drilling and services equipment and contractors so that it is more evenly distributed throughout the year. It is considered a key strategy for addressing the seasonality associated with drilling and services work.

Low scenario – In this report, this term refers to the scenario where low oil and gas prices persist and do not encourage increased capital investment. Oil sands growth is limited to the addition of production from projects currently under construction.

Mcf – A measurement commonly used to express the volume of gas produced, transmitted or consumed in a given period. The equivalent of 1,000 cubic feet of gas.

Mid-career transitioner – In this report, this term refers to a worker that changes their occupation and/or the industry they work for part way through their working career.

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

Petroleum industry – The global processes of exploration extraction, refining, transporting and marketing petroleum products.

Pipeline sector – The sector of the petroleum industry that is responsible for mainline transmission for transporting daily crude oil and natural gas production in Canada.

Reinvestment ratio / reinvestment – Investing distributions back into an original investment.

Replacement demand – Hiring due to age-related attrition.

Retention – The activities based around keeping, or retaining, workers within a company, organization or industry.

Sector – A distinct subset of an industry whose components share similar characteristics. There are seven sectors in Canada's petroleum industry.

Services sector – The contracted exploration, extraction and production services to the E&P and Oil sands sectors. This sector includes:

- **Drilling and completions services** – Include drilling and service rigs activities;
- **Geophysical services (also known as seismic)** – Include survey, permitting and reclamation, line construction, drilling and data acquisition; and
- **Petroleum services** – Include well services, oilfield construction and maintenance, production and transportation services.

Shale – A fine-grained sedimentary rock from which liquid hydrocarbons can be extracted.

Transferability – The 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.

Unconventional – This refers to the process of recovering petroleum using techniques other than the conventional method, e.g. oil shale extraction.

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

Upstream petroleum industry – A term commonly used to refer to the searching for and the recovery and production of crude oil and natural gas. This term is used within tables and some text of the report.

Workforce – The labour pool available in an industry and/or sector.