The Upstream Oilfield Services Industry in Western Canada

A Backgrounder

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Table of Contents

Preface ii

Current Industry Opportunities iii
- Enhanced Oil Recovery iii
- Unconventional Plays iii
- Technology iv
- Integration v
- Liquefied Natural Gas Exports v
- Environmental Services v
- Export of Services/Manufactured Products/Technology vi

Introduction 1
- General 1
  - Upstream 1
  - Midstream 1
  - Downstream 1
- Illustrative Principal Activities 2

The Upstream Oilfield Services Industry 3
- Activities 3
- Industry Characteristics 3
  - Organization 3
  - Competition 4
  - Drivers 4
  - Volatility 4
  - Technology and Innovation 5

Geophysical Services 7
- Subsector Overview 7
- Secondary Subsectors and Activities 7
  - Data Acquisition 7
  - Data Processing and Interpretation 8
  - Data Management, Marketing and Licensing 8
- Illustrative Services and Equipment 8

Drilling and Drilling Support Services 9
- Subsector Overview 9
- Secondary Subsectors and Activities 10
  - Drilling 10
  - Drilling Support Services 11
- The Oil Sands 13
- Illustrative Services and Equipment 13

Completion and Production Services 15
- Subsector Overview 15
- Secondary Subsectors and Activities 16
  - Completion Services 16
  - Production Services 18
- Illustrative Services and Equipment 20

Structuring an Acquisition 21
- General Considerations 21
  - Considerations for an Asset Sale 21
  - Considerations for a Share Sale 22
  - Mutual Considerations 22
- Federal Regulatory Approvals 23
- Environmental Policy and Regulations 24

Current Issues Affecting the Industry 25
- Oil and Natural Gas Prices 25
- Access to Capital 25
- U.S. Oil and Shale Gas Boom 25
- Pipeline Capacity and Market Access 25

Conclusion 27

References 31

Preface

Described by *The Economist* as "the unsung masters of the oil industry," oilfield services are an integral and indispensable part of the oil and natural gas industry in Western Canada. Oilfield services companies are involved in every stage of the life cycle of oil and natural gas development, from exploring for reserves to producing and ultimately abandoning and reclaiming projects. These companies also play a role in transporting, storing, processing, refining and distributing oil and natural gas. The oilfield services industry in Western Canada supports a sector involved in developing and exploiting the world's third-largest oil reserves in a country that is the world's fifth-largest oil and natural gas producer.

Most of Canada's oil and natural gas is contained in the Western Canadian Sedimentary Basin (WCSB), which covers Alberta, northeastern British Columbia and parts of southern Saskatchewan and southwest Manitoba. Because Alberta accounts for more than 80 percent of the WCSB's oil and natural gas production, a large majority of the upstream businesses are based in Alberta and many have their head offices in Calgary.

Bennett Jones LLP is an internationally recognized Canadian law firm founded in Calgary, Alberta, in 1922. Having played an integral role in the development of the Canadian oil and natural gas industry for over 90 years, we have compiled this backgrounder for investors looking for opportunities to invest in a sector that is an indispensable part of that industry.

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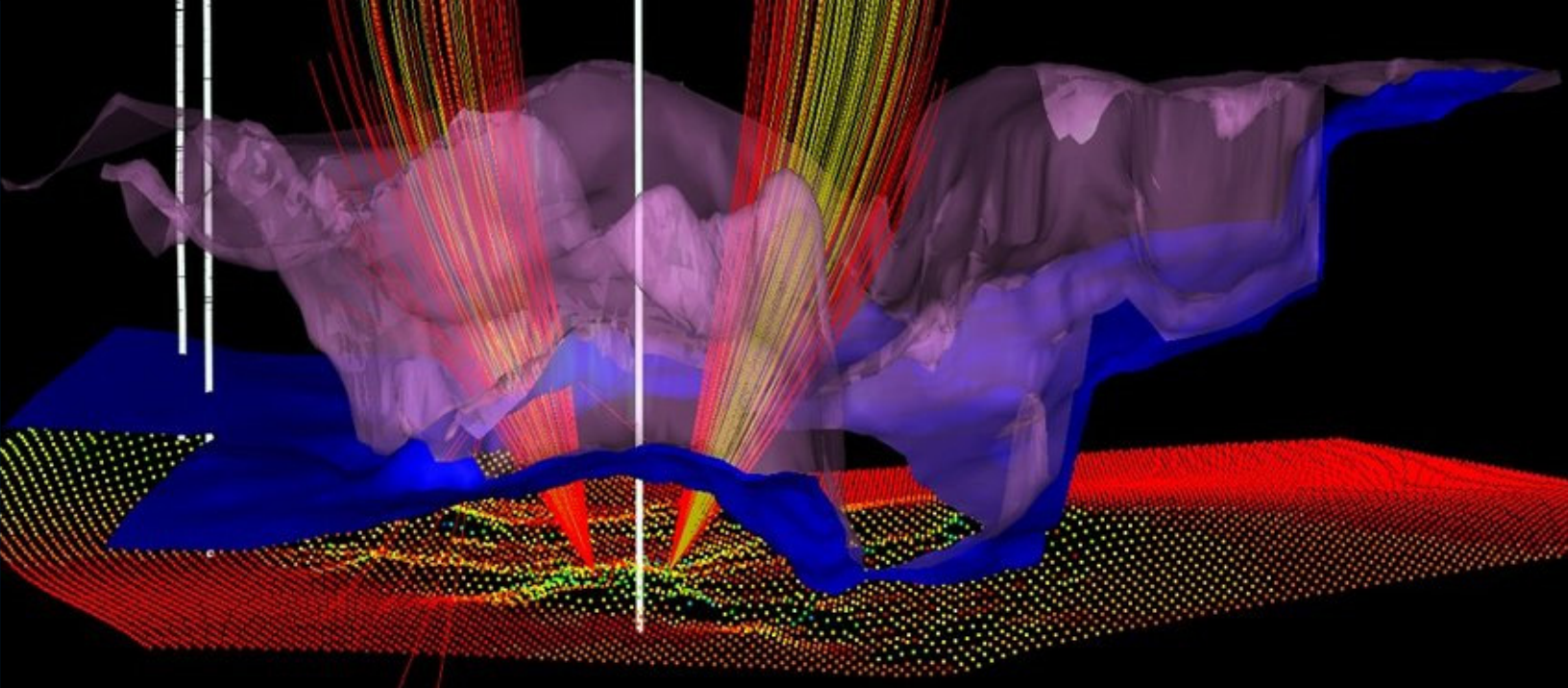


Current Industry Opportunities

Enhanced Oil Recovery

Initially, oil is recovered from a well via primary recovery techniques, which rely on the natural pressure in the producing formation, or mechanical pumps, to get the oil to the surface. However, the average primary recovery rate is only 30-35 percent of the oil contained in the reservoir, and can be as low as 5 percent in certain formations.[1] In order to increase production from current reserves, enhanced oil recovery techniques (EOR) need to be utilized.

Enhanced oil recovery encompasses both secondary and tertiary recovery techniques. Secondary recovery techniques involve injecting water (waterflooding) into the producing formation to maintain sufficient pressure for the oil to flow to the surface. Tertiary recovery involves more advanced techniques such thermal, chemical and gas miscible processes - processes that change the actual properties of the hydrocarbons.

The 2016 BP Technology Outlook predicts that advanced EOR technology could increase recoverable volumes of light oil by an additional 30 percent over current techniques, and could reduce extraction costs by approximately 25 percent by 2050.[2] BP's outlook predicts that simply applying today's best technologies to oil and natural gas resources could significantly increase proven reserves from 2.9 trillion barrels of oil equivalent to 4.8 trillion barrels - nearly double the 2.5 trillion barrels required to meet projected cumulative global demand for oil through 2050.

Regardless of the techniques used, EOR provides opportunities for the upstream oilfield services industry, particularly the completion and production services subsector.

Unconventional Plays

While conventional oil and natural gas production in Canada has been declining for many years, production from unconventional sources has increased dramatically over the past decade, a trend that is expected to continue in both the near and the long term.

Unconventional plays include "tight" oil and natural gas, heavy oil and the oil sands. Tight oil and natural gas are contained in reservoir rocks with low permeability, low productivity and/or susceptibility to formation damage. The rapidly expanding shale gas boom occurring across North America is an example of the efforts being made to exploit various tight natural gas plays. Technological advances in the upstream oilfield services industry, particularly advanced seismic, horizontal drilling and multi-stage horizontal fracking, have made it possible to locate and extract oil and natural gas in places where it was once thought impossible.

The oil sands also present an enormous opportunity for the upstream oilfield services industry. While most people associate the oil sands with open pit mining, it is estimated that approximately 80 percent of the total proven oil sands reserves are buried too deep below the earth's surface to be recovered using mining techniques and are only recoverable via *in situ* technologies. Steam-assisted gravity drainage (SAGD) is the most common of many *in situ* techniques. Regardless of the technique used, however, all *in situ* operations require extensive drilling and related services, and the *in situ* recovery potential in the oil sands provides additional opportunities for the upstream oilfield services industry, particularly drilling and support services, and completion and production services. Solvent-based *in situ* oil sands extraction using chemicals like propane, pentane and butane to produce more oil while using less water may also represent a "step-change" for the oil sands and, possibly, the wider Canadian energy sector.

Notwithstanding the quantity of *in situ* opportunities, traditional open pit oil sands mining will continue to provide opportunities for upstream oilfield service companies, particularly with respect to reducing greenhouse gas (GHG) emissions, creating efficiencies in natural gas and water usage, waste management and project site reclamation.

In the oil sands business, new capital projects and expansions at existing projects represent only a portion of the opportunities for oilfield service companies. With annual and reoccurring oil sands maintenance costs forecast to increase over the next decade, there is anticipated to be substantial maintenance work for the upstream oilfield services industry, despite current and forecasted decreases in capital expenditure in the sector due to depressed oil prices.[3]

In addition, another suite of innovators are attempting to take one resource and turn it into other, more valuable or convenient resources. Various companies are using new engineering and technology to upgrade heavy oil and bitumen. Heavy oil and bitumen have greater densities than light crude oil; they are more expensive to refine and produce more pollution; however, there is much more heavy oil and bitumen in the world than light crude. Advances in refining and upgrading provide additional opportunities for unconventional plays.

Technology

The current low-price environment and the oversupply of oil and natural gas in the market have led to an urgency to innovate through technology. It is widely believed that exploration and production (E&P) companies will become more dependent on services companies for technological solutions to extract oil and natural gas more cheaply. This presents opportunities across all subsectors of the upstream oilfield services industry, but in particular the drilling and drilling support services subsector and the completion and production services subsector.

Technology offers help with innovation on two fronts: (i) raising short-term production; and (ii) reducing capital costs and operating expenses directly. Both fronts emphasize efficiency. Areas of active technological development affecting efficiency include the following:

Seismic imaging. The emergence of three-dimensional seismic imaging during the 1990s had a dramatic impact on oil and natural gas exploration. Since then, seismic technologies have advanced, and exploration companies can now examine the subsurface from different orientations and over time. Multi- and wide-azimuth technologies, for example, enable surveys to be carried out in different directions over the same area. Furthermore, 4D seismic plays an increasingly important role in helping to determine how reservoirs are changing over time as oil, natural gas and water move through the subsurface and are produced. Understanding reservoir structure, rock and fluid properties is critical to cost-effective, large-scale developments and to maximizing the recovery of unconventional hydrocarbons.

Digital technologies. Investment in the digital oilfield is predicted to outperform the general oilfield services market over the next decade. The digital oilfield is a web-based visualization platform from which companies can manage, measure and track all of the data coming from the entire oilfield allowing companies to predictively support operational decisions in real time. "Digital" is a broad term that includes sensors, telecommunications networks, simulation and optimization, and robotics, coupled with advanced monitoring and computational processing capacity and expertise.

The oil and natural gas industry is tailor-made for digital transformation — operations typically span multiple regions, with heavy capital investments and extended supply chains. The efficiencies provided by digital technologies and advanced analytics can give management unprecedented views into operations, increase agility and support better strategic decision making. Data driven analytics will also allow operators to (i) run equipment and facilities closer to the design capacities, (ii) detect when a piece of equipment is going to fail, and (iii) help identify "sweet spots" in unconventional oil and natural gas plays.

Robotics and unmanned systems. Oil and natural gas exploration is today conducted in some of the most remote places in the world. E&P companies are beginning to look to technology solutions from other industries, such as the defense and manufacturing sectors, to manage these distances by adapting those technologies to oil and natural gas operating environments. Applications include deploying robots to inspect difficult-to-access structures and piloting unmanned aerial vehicles into areas that are dangerous for human intervention or difficult to reach.

Environmental. Oil and natural gas operations are increasingly attracting the attention of environmental groups, government regulators and local communities. To continue to be successful, E&P operators must develop additional ways to reduce their environmental footprint. Current areas of focus include the use of more environmentally friendly chemicals and additives in drilling muds, cement and hydraulic fracturing water, produced water handling, emissions and flaring, and noise pollution. In addition, the use of solar and wind energy for steam and power applications is receiving close attention as an area of opportunity for oilfield services companies to exploit.

Integration

It is predicted that with the added pressure of a "lower-for-longer" price environment, oilfield services companies will add to their current capabilities to offer more services across the value chain. The trend within the sector towards the provision of more integrated services to operators, will lead to service sector consolidation, as the larger and more dynamic services companies continue to build capabilities and competencies over a wider range of activities.

According to Spears and Associates, in 2010, 5 percent of a major services company's sales were integrated services. In 2015, the number was 15 percent and in 2020 it is predicted to be 25 percent. The industry is moving toward integrated project management handled by service companies.

The integration trend represents an opportunity for forward thinking companies in all subsectors of the oilfield services industry.

Liquefied Natural Gas Exports

The export of liquefied natural gas (LNG) has the potential to be a boon for the western Canadian upstream oilfield services industry. In contrast to oil, which is priced globally due to the relative ease of transporting it, natural gas is priced regionally. Natural gas trades in Asia at multiples of two to three times the price in North America. Asia is also energy hungry and represents an export destination for natural gas, an abundant commodity in Canada. LNG exports to Asia from the coast of British Columbia could serve to increase the demand for natural gas, increasing exploration and production activities, and ultimately activity levels in the upstream oilfield services industry. However, while a number of large LNG export projects have been announced for northwestern British Columbia, there are still significant economic and legal hurdles. As the hurdles are overcome, oilfield services companies can expect increased demand across all subsectors of the industry.

Environmental Services

Increased environmental awareness, coupled with stricter environmental policies and complex regulatory regimes, provides an opportunity for oilfield services companies that specialize in providing environmental services. Companies seeking to capitalize on this trend are developing innovative solutions to reduce GHG emissions, reduce the physical footprint of oil and natural gas activities, and reduce water usage and waste.[4]

Legislation in Alberta and British Columbia puts a price on GHG emissions, and future policies, at both provincial and federal levels, may be enacted to further reduce GHG emissions. Services companies that can reduce GHG emissions for the upstream oil and natural gas industry, and thereby reduce costs of production, will become increasingly sought after if further prices and/or restrictions on GHG emissions are imposed.

Oil and natural gas activities also invariably have a physical footprint. Historically, the footprint for a well was significant. Thirty years ago, the footprint of a single well was between 20 and 80 acres.[5] Today, less than 1 acre is necessary to access 80 acres of an underground reservoir.[6] By further reducing the area of land needed to explore for, develop and produce oil and natural gas, upstream oilfield service companies can reduce the amount of land ultimately required to be reclaimed, which would have the twofold effect of reducing costs and limiting the environmental impact of oil and natural gas activities.

Significant amounts of water are used in the production of oil and natural gas, particularly in unconventional oil extraction. Two of the largest consumers are oil sands operations and the hydraulic fracturing, or fracking, industry. In 2013, the oil sands sector withdrew 200 million cubic metres of fresh water, which contributed, in part, to the approximately 182 square kilometres of tailings ponds that exist in northern Alberta.[7] Depending on the geology and the specific configuration of an oil or natural gas well, it has been estimated that fracking uses from 200,000 to upwards of 9 million gallons of water per well. Improving water-use management, including conservation and recycling, represents a major opportunity for the upstream oilfield services industry.

Oil and natural gas activities also generate significant waste, such as drilling mud, frack fluid and tailings ponds. There is extensive government regulation of the handling, removal, treatment and disposal of such waste. Upstream oilfield service companies involved in waste removal, treatment, disposal and recycling are well-positioned to capitalize on the trend towards more stringent environmental oversight.

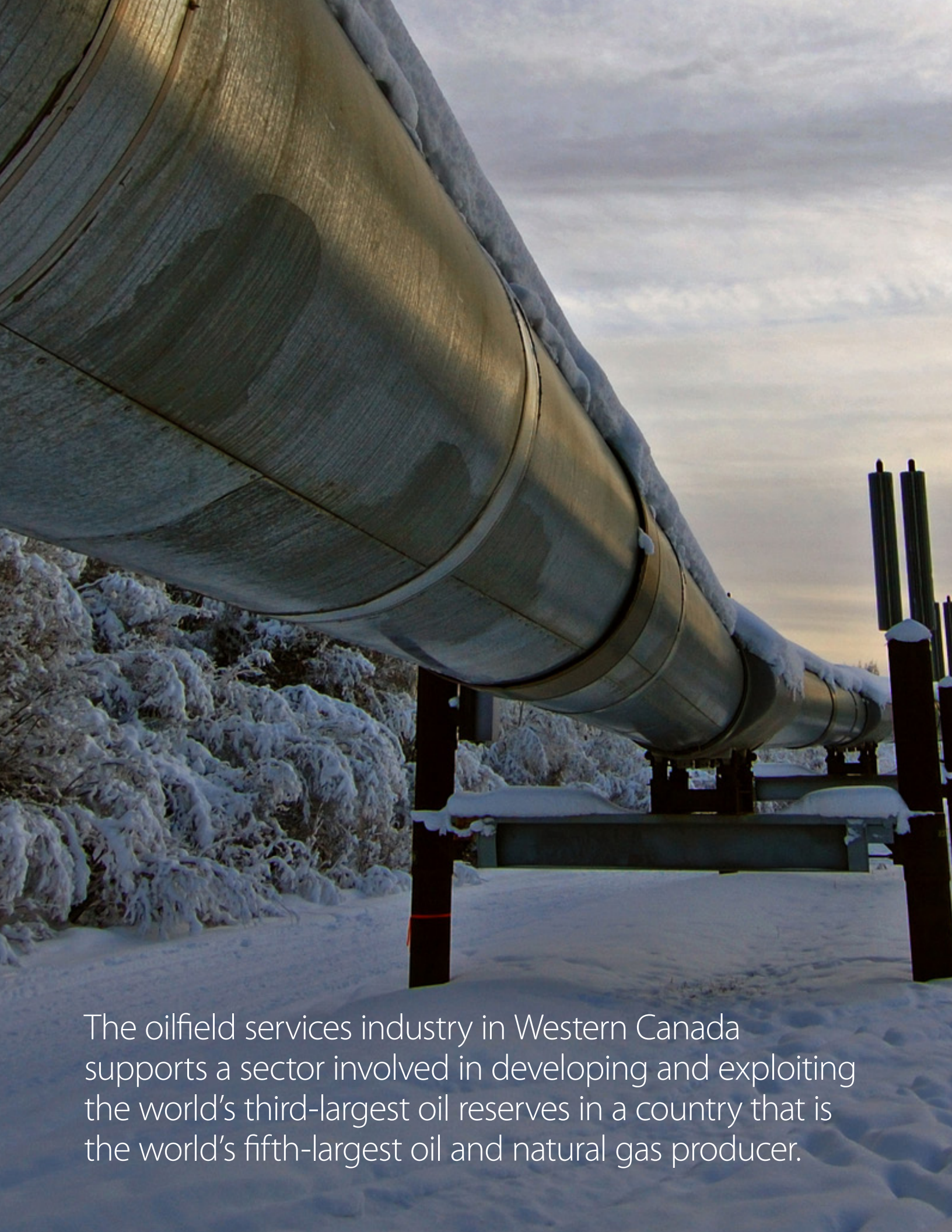
Export of Services/Manufactured Products/Technology

The Canadian upstream oil and natural gas industry has attained an international reputation for excellence in many areas, including the following:

- high-tech exploration and production methods
- cold-climate operations
- development of oil sands, heavy oil and sour gas
- gas processing, sulphur extraction and heavy oil upgrading
- construction, operation and maintenance of pipelines
- specialized controls and computer applications
- services, equipment and training for environmental protection and safety

Oilfield services companies supporting these areas have the opportunity to export their skills to other oil and natural gas producing regions around the world looking to benefit from Canada's expertise. International diversification provides a growth opportunity for all subsectors of the industry.

In addition, Canada has become known for its technological innovations in oil and natural gas production and is a major manufacturer and exporter of oilfield technologies and equipment. Over the years, many U.S. and international firms have looked to Canada for opportunities to acquire innovative companies with proprietary technologies that can then be exported to other energy-producing regions around the world. As the search for oil and natural gas demands ever-more sophisticated technologies to drive efficiencies in extraction and production, Canada will continue to be a destination for foreign capital looking for ways to expand internationally.



The oilfield services industry in Western Canada supports a sector involved in developing and exploiting the world's third-largest oil reserves in a country that is the world's fifth-largest oil and natural gas producer.

Introduction

General

The Canadian oil and natural gas industry explores, develops, produces, transports, processes, markets, distributes and sells Canada's oil and natural gas resources. The industry can be divided into three principal sectors: (i) upstream, (ii) midstream and (iii) downstream.

Upstream

The upstream sector comprises two industries – the E&P industry and the oilfield services industry. E&P companies are engaged in the exploration for, and development and production of, oil and natural gas reserves. The E&P industry is comprised of three types of companies: (i) major integrated oil and natural gas companies, (ii) national oil companies (NOCs), and (iii) independent oil companies (IOCs).[8] Internationally, the major integrated companies are involved in the production, refining and marketing of oil and natural gas. NOCs are engaged in production and refining, but typically are less involved in marketing. IOCs are usually focused exclusively on exploration and production. The Canadian E&P sector comprises over 1,000 E&P companies[9] most of which are IOCs. While there are currently no homegrown NOCs in Canada, foreign NOCs operate here.

Contrary to common conception, E&P companies themselves typically perform only a small portion of the actual activities required to ultimately produce oil and natural gas. Over time, E&P companies have increasingly become asset portfolio owners, more at arm's length from the execution of operations and support services needed to produce oil and natural gas. Oilfield service companies have established themselves as the heavy lifters of the oil and gas industry.

The oilfield services industry exists to serve the E&P sector, and provides all the services necessary to locate, develop and produce oil and natural gas assets. Oilfield service companies are involved in practically every stage of the life cycle of the exploitation of oil and natural gas resources from initial exploration to project abandonment and reclamation of the land. Accordingly, the oilfield services industry is an indispensable part of the upstream oil and natural gas industry.

Midstream

The midstream sector is involved in the transportation, processing, storage and wholesale marketing of commodities such as crude oil, natural gas and natural gas liquids and provides the link between remote resources produced in the upstream sector and the ultimate consumer. The point where the upstream sector ends and the midstream sector begins is at the gathering system, which collects oil and natural gas from the various points of production and transports it to plants for processing. Pipelines are a critical part of the transportation infrastructure in the midstream sector. An example of processing that occurs in the midstream sector is the removal of sulphur compounds and liquids from natural gas through chemical and physical processes including heat, cooling and catalysts. Another example of processing is "upgrading," which is the process by which bitumen – the raw product obtained from oil sands – is converted into synthetic crude oil. Once processed, oil and natural gas are marketed as commodities, which may be bought by refiners and distributors.

While not the focus of this backgrounder, it is noted that the oilfield services industry also provides services to the midstream sector. These services consist mainly of providing engineering, construction and maintenance to midstream facilities, such as pipelines, gas processing plants, tank farms and transloading facilities.

Downstream

The downstream sector is involved the refining of crude oil into useable products such as gasoline and the distribution and sale of oil, natural gas and petroleum products to the ultimate customer. This sector is comprised of refiners, petrochemical plants, natural gas distribution companies and retail outlets such as gas stations. While also not the focus of this backgrounder, it is noted that the oilfield services sector also provides services to the downstream sector similar to those that it provides the midstream sector. These services consist primarily of assisting in the engineering, construction, commissioning, maintenance, repair, decommissioning and shutdown of downstream facilities, such as refineries. Other services provided by the oilfield services industry include transportation and environmental services.

Illustrative Principal Activities

The following diagrams provide a visual representation of the three principal sectors of the oil and natural gas industry, along with illustrative examples of their respective principal subsectors and a list of the principal activities performed by the oilfield services industry.

Upstream

Geophysical

Principal Activities

- seismic surveys
- data acquisition
- data processing and interpretation
- data marketing and licensing

Drilling and Support

Principal Activities

- wellsite construction
- drilling
- logging
- casing
- environmental services

Completion/ Production

Principal Activities

- well completions
- pressure pumping
- well servicing
- enhanced oil recovery
- environmental services

Midstream

Transportation

Principal Activities

- transportation services
- pipeline construction
- pipeline cleaning and testing
- environmental services

Processing/Upgrading

Principal Activities

- sulphur and liquids removal
- plant design, construction and maintenance
- shutdown and turnaround operations
- bitumen upgrading

Storage

Principal Activities

- vessel design and installation
- tank cleaning, maintenance and retrofitting
- wholesale marketing

Downstream

Refining

Principal Activities

- refining of crude oil
- upgrader/ refinery construction
- maintenance, shutdowns and turnarounds

Conversion

Principal Activities

- production of petrochemicals
- petrochemical plant construction, maintenance and shutdown

Distribution

Principal Activities

- fluid transportation/ sales
- natural gas distribution
- environmental services

The Upstream Oilfield Services Industry

Activities

The upstream oilfield services industry can be broken down into three principal subsectors that roughly correlate with the various stages of oil and gas projects. Although there may be overlap in certain areas, and some companies provide services in more than one subsector, the three principal subsectors are the following:

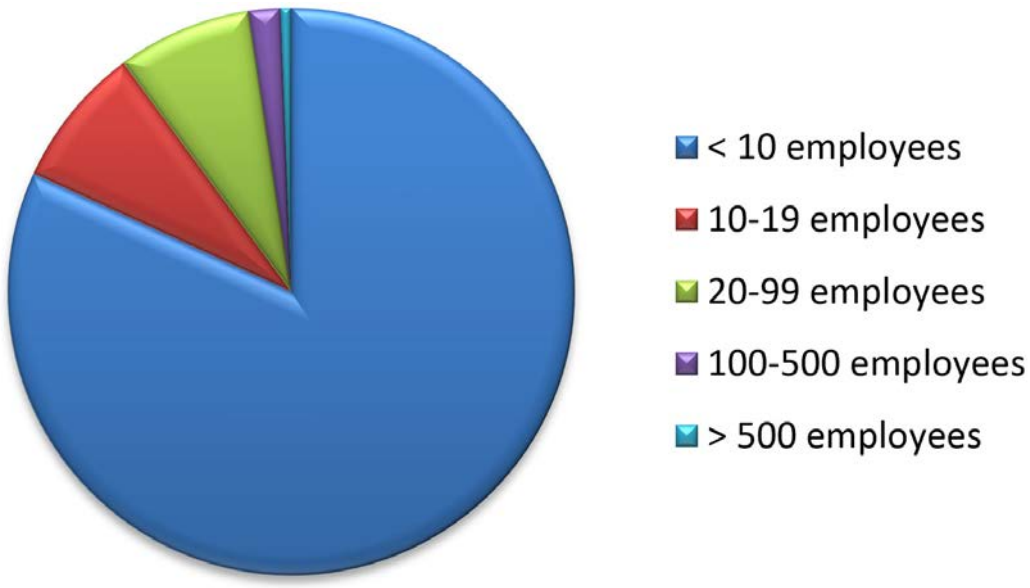
- geophysical services
- drilling and support Services
- completion and production services

Industry Characteristics

Organization

The upstream oilfield services industry is composed of thousands of companies of various sizes that operate on local, regional, national and international scales. Large national and international oilfield service companies are typically integrated entities that provide a wide range of services across the spectrum of oilfield services. Smaller local and regional outfits tend to specialize in a particular service offering, such as seismic data acquisition or wellsite preparation and construction. While the level of concentration varies by subsector, overall the oilfield services industry in Western Canada is particularly fragmented, with 90 percent of companies employing less than 20 people.[10] The largest employers, however, have well over 5,000 employees.[11] Levels of concentration tend to increase with the capital intensity of a particular subsector as large firms have a distinct competitive advantage in the provision of services that are highly capital intensive. However, numerous opportunities exist for small and medium sized oilfield service companies.

Figure 1: Industry Concentration



Source: Conference Board of Canada, Canada's Oil and Gas Support Activities Industry, Canadian Industrial Profile Spring 2014 (June 2014); Statistics Canada

Competition

The upstream oilfield services industry is highly competitive. This is primarily due to relatively low barriers to entry, which is in turn a function of relatively low capital expenditure requirements.[12] The principle competitive factors in the oilfield services industry are product and service quality and availability; technical knowledge and expertise; reputation for safety; and price.[13]

Competition within the upstream oilfield services industry is also strongly influenced by technological and financial resources.[14] Upstream oilfield service companies that can offer their customers better resource identification and recovery techniques, which in turn reduce costs and increase profits for E&P companies, possess a distinct competitive advantage in the oilfield services industry. Technological innovation and application is therefore a key factor affecting inter-firm levels of competitiveness. Due to the costs associated with research and development activities, upstream oilfield service companies with better access to financial resources are more favourably positioned to make technological advances and increase market share. At the subsector level, other factors, such as locational advantages in the drilling subsector, may also affect competition.[15]

Drivers

Demand for upstream oilfield services is driven primarily by the level of activity in the Canadian E&P industry, which is dependent on a number of factors, including: current oil and gas prices; expectations about future oil and natural gas prices; the cost of exploring for, developing and producing oil and gas; expected rates of declining current production; discovery rates of new oil and gas reserves; available transportation capacity; and global political, economic, weather and regulatory conditions.[16]

Due to its reliance on oil and natural gas prices, capital expenditure by E&P companies tends to be cyclical. As oil and natural gas prices rise, E&P companies increase production from current reserves and exploration activities. As production capacity increases, oil and gas prices eventually fall, reducing capital expenditure. Consequently, the demand for upstream oilfield services is also cyclical in nature. In periods of depressed oil and gas prices, however, E&P companies look to the upstream oilfield services industry to help reduce costs and increase efficiency.

The relative maturity of oil and natural gas reserves and the characteristics of oil and natural gas fields also have an effect on the levels of activity for subsectors within the industry.[17] As oil and natural gas fields mature, drilling activity declines and the demand for EOR services increases.[18] A decline in conventional resources and an increase in unconventional production also increase the demand for EOR services.

Volatility

Due to its heavy dependence on the level of activity in the E&P industry, which in turn bears a strong positive correlation to cyclical and volatile oil and natural gas prices, the upstream oilfield services industry is characterized by a high degree of volatility.

The volatility of the upstream oilfield services industry varies by subsector and activity levels in each subsector are a function of how the E&P industry varies its capital expenditure in response to cyclical oil and natural gas prices.[19] The completions and production services subsector, due to the breadth of services it provides, is generally the most resilient to cyclical changes in oil and natural gas prices.[20] Companies involved in production services, particularly well servicing and enhanced recovery operations, are also the first to revive from periods of depressed oil or natural gas prices because the quickest way to take advantage of rising oil or natural gas prices is not through the drill bit, but rather through increased recovery from existing reserves.[21] As oil or natural gas prices rise further, E&P companies respond through increased capital expenditure on completions and drilling. At this stage, the drilling and support services and the completion and production services subsectors experience increased activity levels. Further price increases benefit the drilling and support services subsector as E&P companies increase capital expenditures on drilling, thus increasing drilling rig utilization rates. Lastly, as existing prospects are developed, E&P companies increasingly focus on the identification of new prospects, the key beneficiary of which is the geophysical services subsector. Accordingly, the geophysical services subsector is generally the last to benefit from rising oil or natural gas prices.[22] The geophysical services subsector is also usually the first to experience decreased activity levels when oil or natural gas prices begin to drop as E&P companies reduce exploration activities.

Technology and Innovation

Due to the nature and evolution of the oil and natural gas industry, technology and innovation are key factors to the success of upstream oilfield service companies. Exploring for, developing and producing oil and gas is a complex and expensive business. Upstream oilfield service companies that can better locate oil and gas reserves, reduce development and production costs, unlock unconventional reserves and increase ultimate recovery rates possess a distinct competitive advantage over their competitors. The primary way to obtain this advantage is through technological innovation. Three of the most profound technological innovations that have transformed the oil and natural gas industry are advanced seismic, horizontal drilling and multi-stage hydraulic fracturing, which combined have provided the necessary technology to increase production from conventional reserves and unlock unconventional reserves that were once thought to be impossible to capture. As conventional reserves decline, these and new technologies aimed at the recovery of unconventional oil and gas reserves will become increasingly important. Innovations that can help reduce GHG emissions, reduce water use, and aid in the management and recycling of waste products also have the potential to further transform the oil and natural gas industry.

Geophysical Services

Subsector Overview

Historically, the locations of oil and natural gas reserves have made exploration an expensive and risky business. During much of the 20th century, drilling a "wildcat" well had about a 20 percent chance of success.[23] Technological advancements, however, have increased the chance of success of such wells significantly – today, the likelihood of striking oil ranges between 30 percent and 50 percent.[24]

Currently, seismic surveying, which involves sending acoustic waves into the earth and recording, processing and interpreting the results, is the most popular exploration technique. Seismic data is also used by E&P companies to establish the extent of existing reserves and to manage producing reserves.

The geophysical services subsector in Western Canada is highly competitive and fragmented. The subsector is comprised of a full spectrum of services providers, from large multi-national full service companies to sole proprietorships.[25] Full services firms are involved in all stages of geophysical exploration, from acquisition of field data to the management and marketing of seismic data. Smaller firms tend to specialize, and are involved in only one or two stages of geophysical exploration, such as data acquisition.

As with the upstream oilfield services industry in general, the geophysical services subsector is subject to both industry cycles and seasonality. This subsector is usually the last to profit from rising oil or gas prices, and is generally the first to experience activity declines as oil or natural gas prices drop. The majority of new seismic data is acquired from November to March when companies can take advantage of the frozen ground conditions. Demand for geophysical services declines in the summer, when such activities can only be undertaken in drier, often more southerly areas.

The geophysical subsector is also subject to extensive environmental regulations. Government approvals and permits are required before seismic activities can be undertaken. Land utilized for seismic surveys must also be reclaimed within a set period of time after the field operations are complete. Low impact compaction, survey, and clearing techniques have helped reduce the environmental impact and associated remedial costs of seismic operations.

The geophysical services subsector can be further broken down into three secondary subsectors: (i) data acquisition, (ii) data processing and interpretation, and (iii) data management, marketing and licensing.

Secondary Subsectors and Activities

Data Acquisition

The first step in seismic operations is data acquisition, or field operations, which encompasses four main phases: line clearing, surveying, drilling, and recording. As most oil and natural gas reserves are in remote, wooded areas, the first step involved in most seismic operations is line clearing, which involves the cutting and removal of trees and vegetation to provide site access for equipment and source and receiver points, from which the acoustic waves are created and recorded, respectively. Once a site has been sufficiently cleared, exact points for the source and receiver locations must be determined, which requires surveying. Next, "shot holes" are often drilled, in which an energy source, such as an explosive, is placed. Alternatively, where the ground is sufficiently solid, large vibrator trucks may be used to create the initial seismic shock. Finally, receivers, known as "geophones," and cables are laid out for explosion initiation and data recording. The explosion or vibration sends acoustic energy into the subsurface in the form of a seismic wave. The seismic waves are then reflected off the various substrata and recorded by the geophones on the surface. Different substrata cause changes to the velocity and travel path of the energy waves allowing a picture of the subsurface to be created. Once recorded, this seismic information is then converted into digital form and is ready for processing and interpretation.

While larger, full-service geophysical companies conduct their own field operations, field operators are often subcontracted by data management, marketing and licensing companies.

Data Processing and Interpretation

Once seismic data has been recorded and converted into digital form, it is ready for processing, which is necessary to create images of the underground rock layers that are capable of interpretation. Processed seismic data is displayed on a seismic image or record, which is similar to a vertical cross-section of the earth.[26] A processed seismic image will display any subsurface deformations in the layers of horizontal sedimentary rock that are necessary for the existence of oil or natural gas. The accuracy and usefulness of seismic exploration has been greatly improved by the computer processing of digital seismic data.[27]

Processed seismic data can take three forms, depending on the technique used to collect it. Two-dimensional (2D) seismic images are created by shot holes and recorders that are placed in a straight or relatively straight line. 2D seismic provides a cross-sectional image of the subsurface directly below this line. 2D seismic is utilized primarily to generate large, regional leads in undeveloped areas.[28] Three-dimensional (3D) seismic images are created by placing shot-holes and recorders in a grid formation. The resulting 3D seismic image provides a more precise image of subsurface geological formations and consequently reduces exploration and development costs by both minimizing the percentage of exploratory wells that need to be drilled and permitting the optimal number and best placement of development wells to efficiently drain the oil or natural gas reservoir.[29] 3D seismic data is especially important for horizontal drilling, unconventional plays and reservoir management.[30]

A more recent innovation in data processing is four-dimensional (4D), or time lapse seismic data, which is the product of 3D seismic data for a particular area taken over a period of time. 4D seismic data is important for tracing the flow of fluids through a reservoir and is often utilized in the management of producing reserves.

Once processed, seismic data undergoes interpretation to determine the potential for the existence of hydrocarbons. The interpretation of seismic data is a complex endeavor that involves the use of sophisticated computer software and geological expertise. Special rooms, sometimes called visualization centers, are often used to display holographic 3D seismic images. The interpretation of seismic data is often done by E&P companies themselves.

Data Management, Marketing and Licensing

Some geophysical companies specialize in data management, marketing and licensing. These companies often have extensive libraries of seismic data, which they market to E&P companies with the ultimate goal of licensing the data. A large volume of 2D and 3D seismic data exists in Western Canada, with an estimated 2D market of approximately 1.3 million kilometres and an estimated 3D market of approximately 124,000 square kilometres.[31] The level of concentration in the data management, marketing and licensing sector is very high. More than 80 percent of the 2D seismic market is owned by two companies, and the four largest owners of 3D seismic data libraries account for approximately 85 percent of the 3D market.[32] Companies that specialize in this sector often subcontract data acquisition companies to conduct the field operations necessary to gather the desired seismic data. Geophysical companies in this subsector must also compete against E&P companies which may choose to license their own seismic data to customers.

Illustrative Services and Equipment

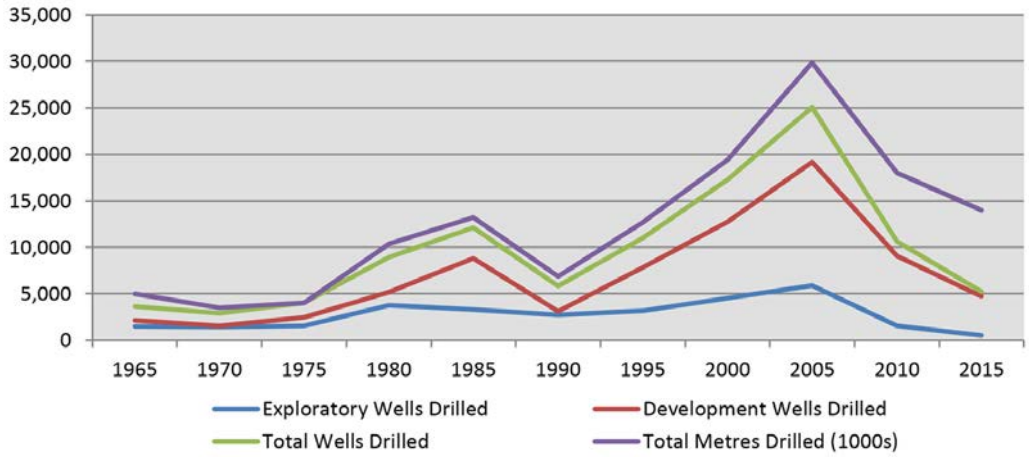
See Schedule A for a table that illustrates the breadth of service providers and equipment/ products found in the geophysical services subsector.

Drilling and Support Services

Subsector Overview

The drilling and support services subsector is the second largest subsector in the upstream oilfield services industry. This subsector is comprised of two principle secondary subsectors: (i) drilling, and (ii) drilling support services. Drilling companies make up the largest portion of this subsector. Drilling support services, which include oilfield construction, transportation, logging and environmental services, constitute the rest of the subsector.

Figure 2: Wells and Metres Drilled in Western Canada



Source: CAPP Statistical Handbook

It is evident from Figure 2 that drilling activity, overall, increased dramatically from 1965 to 2005. This trend was not uniform, however, as the growth in the number of development wells drilled over this period far exceeded the growth in the number of exploratory wells drilled. These trends are evidence of a decline of conventional oil and natural gas resources in the WCSB. Since peaking in 2005, the number of exploratory and development wells drilled has steadily declined, and the recent downturn in oil prices has significantly reduced the number of wells being drilled as E&P companies look to cut costs and increase efficiency.

Another trend that is apparent from Figure 2 is that the average number of metres drilled per well began to noticeably increase in the past 10 years. Historically, the average number of metres drilled per well was relatively constant. However, due to declining conventional reserves and resulting technological innovations, particularly horizontal drilling, the average number of metres drilled per well has increased over the past decade. Since 2005, average well depth has almost doubled, from 1,150 metres to slightly more than 2,000 metres, and the percentage of horizontal wells drilled has increased by a factor of six, from approximately 10 percent to just over 60 percent.[33] These trends are expected to continue in the future as E&P companies increasingly develop unconventional resources and *in situ* operations in the oil sands become more prevalent.

The drilling and support services subsector, like the upstream oilfield services industry in general, is subject to the cyclicality, volatility and seasonality that characterize the E&P industry. When oil or gas prices begin to rise, this subsector is usually second, after the completion and production services subsector, to experience increased activity as E&P companies increase drilling expenditure. This subsector benefits from the fact that E&P companies must continually drill to find new reserves and replace and increase production from existing reserves to maintain viability.

Earnings and cash flow for drilling companies is affected by a number of factors, including the average day rate per rig, the supply of rigs available to meet drilling demands, the average cost and skill set of the labour operating the rigs, and the length of the drilling season.[34] Another key metric for profitability of drillers is rig utilization rates, which have fallen to historic lows in the wake of the latest downturn in oil prices.

Competition is also fierce in the drilling and support services subsector. The high level of competition in the subsector is due to relatively low barriers to entry, which have resulted in a fragmented industry with many small companies providing specialized services.[35] This subsector is moderately capital intensive and relatively labour intensive.[36] With respect to drilling, periods of high demand often lead to higher capital expenditure by E&P companies, which in turn increases the number of available rigs. Due to the relatively long lifespan of drilling rigs and the waiting period between when a decision is made to buy new rigs or upgrade existing ones and the when the rigs are placed into service, industry supply may occasionally exceed demand.[37] Locational advantages may also be a factor affecting competition in the contract drilling subsector as companies that operate drilling rigs within a given region have the capability to move rigs or set up new rigs within that region faster than companies that do not operate any rigs in that region.[38]

This subsector is also dependent on extensive technological innovation, especially with respect to drilling itself. Complex drilling programs for the exploration and development of both conventional and unconventional oil and natural gas require high performance drilling rigs, which in turn require advanced drilling fluids and environmental support services.[39]

As with the upstream oilfield services industry in general, the drilling and support services subsector is affected by numerous laws, regulations and guidelines relating to health and safety and the protection of the environment. These laws address matters such as spills, releases, emissions, the handling and discharge of hazardous substances and environmental remediation.

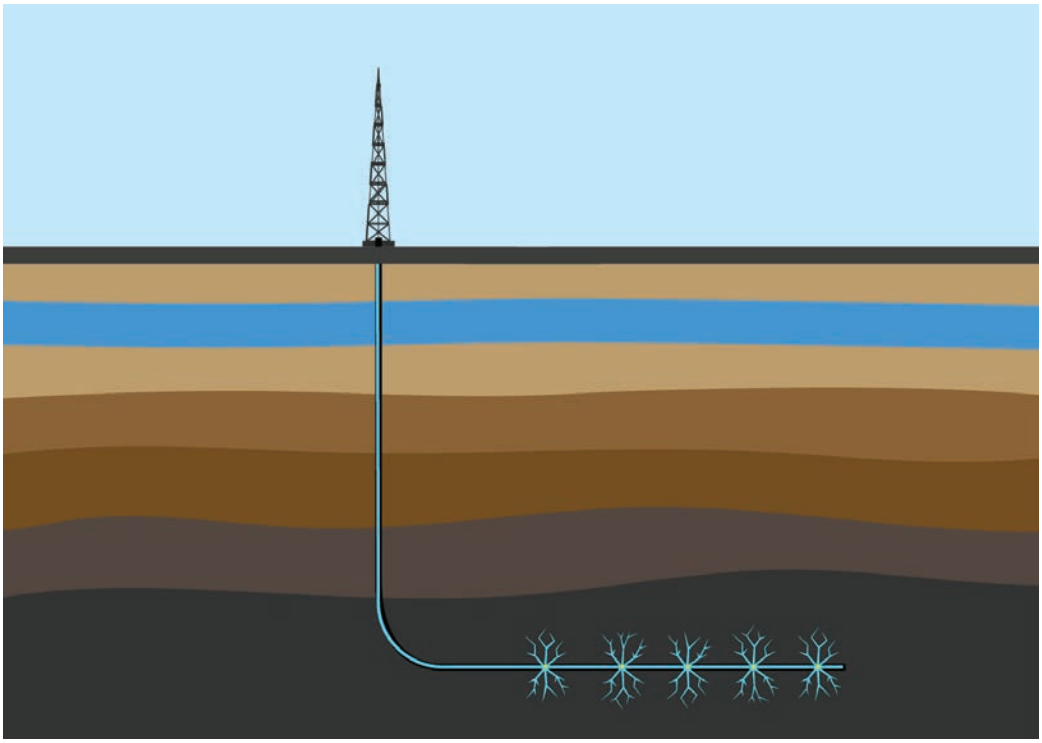
Secondary Subsectors and Activities

Drilling

There are two primary types of wells – exploratory wells and development wells. An exploratory well is drilled to discover new oil or natural gas reserves. Even with the utilization of advanced geophysical techniques to locate oil and natural gas, drilling an exploratory well is still the only way to truly know if an oil or natural gas reserve exists. Development wells are wells that are drilled within the known extent of an oil or natural gas reservoir and are used to increase production from existing reserves. Both types of wells generally involve the same drilling process. The cost of drilling a well, and the time required to drill the well, vary substantially based on the location and depth of the well. Whereas a shallow well can cost as little as $50,000, deep wells in the WCSB can cost $10,000,000 or more.[40] A shallow natural gas or heavy oil well in eastern Alberta or Saskatchewan may take only two or three days to drill to a target depth of 450 metres, whereas it may take up to eight months or more to reach a target depth of 4,500 metres in the foothills of the Rocky Mountains.[41] The number of workers employed depends on the type of well being drilled. In general, however, drilling one well employs about 75 workers, although as few as four to seven workers may be active on the rig at any given time.[42]

Various techniques exist for drilling a well. Vertical drilling is the oldest technique and, as its name suggests, involves drilling a vertical wellbore into a potential or established oil or natural gas reserve. A more modern technique is directional drilling, which involves drilling a well vertically to a point at which the wellbore is deflected at a predetermined angle. A form of directional drilling that has become increasingly popular as a means to tap unconventional oil and natural gas reserves is horizontal drilling, which was first used in Western Canada in the late 1980s. Horizontal drilling is utilized in shale gas, tight oil and heavy oil plays, as well as in the oil sands. Today, the horizontal segment of a well can extend for almost 10 kilometres and it is even possible to drill horizontal laterals, which are additional drainage wells that branch-off from the horizontal wellbore.[43] This permits the drilling of a number of wells from a single location while minimizing damage to environmentally sensitive areas. Due to declining conventional resources, horizontal drilling has become one of the most important technological advances in the upstream oilfield services industry.

Figure 3: Diagram of a Horizontal Well



Horizontal drilling is typically more time consuming and more costly than conventional vertical drilling, with the cost of one horizontal well ranging from $3 to $4 million, or higher, depending on completion costs.[44] However, horizontal drilling possesses a number of distinct advantages over vertical drilling. First, horizontal drilling techniques permit E&P companies to unlock oil and natural gas trapped in unconventional reserves that cannot be economically recovered by a vertical well. Second, it can reduce the number of wells required to drain a reservoir. Third, horizontal drilling can increase the ultimate recovery from an oil reservoir from 50 to 75 percent of the total oil in the reservoir.[45] Fourth, it dramatically reduces the above surface foot print required to access an entire reservoir.

Drilling Support Services

There are numerous support services for the drilling subsector that are a necessary part of the drilling process. Some of the most important drilling support services are discussed below.

Oilfield Construction

Due to the location of most oil and natural gas resources in the WCSB, it is usually necessary to construct an access route and clear a wellsite before drilling operations can begin. Drilling companies may perform this construction in-house or hire oilfield construction contractors. Construction of an access route first involves removal of vegetation from the proposed access route. After that, heavy equipment is used to construct a graded road. The surface is then compacted and treated to minimize soil erosion and crushed aggregate is added to the surface.

Similarly, wellsite construction initially involves the removal of vegetation on the proposed wellsite. Heavy equipment is then used to level and compact the surface so that it can support the drilling rig. Boards or matting may also be required. Where permafrost is an issue, a gravel pad can be used to prevent melting. Next, a large pit, known as a reserve pit or sump, is dug and lined with plastic next to where the drilling rig is to be located.[46] The reserve pit is used to hold unwanted by-products of the drilling process, such as mud, cuttings and other material from the well.

Increasingly, large tanks are used in place of reserve pits to store waste products from the drilling process. As drilling activity is highest in the winter months, oilfield construction companies also provide snow plowing, sanding and winter access services.

Transportation Services

Due to the often remote location of oil and gas resources and the extensive amount of equipment used in drilling for oil and gas, the transportation services subsector is integral to upstream oilfield services operations. Transportation service companies typically have diversified fleets of trucks and trailers and provide both short and long-haul services and often work is done in tandem with drilling contractors to move rigs and other drilling specific equipment between well sites. Many of these companies also transport camps, bins, light towers, rig mats, testing equipment and other oilfield equipment to and from well sites.

Geophysical Logging Services

The cost of completing a well is typically more than the cost of drilling the well.[47] Therefore, before completion activities are undertaken, a well is tested to determine whether recoverable oil or natural gas exists. Well testing is performed by analyzing well logs, which are records of the geological formations and their fluids encountered in drilling the well.[48] Commonly used logging techniques include: (i) mud logging, (ii) logging-while-drilling, and (ii) drillstem testing. These services are often performed by geophysical companies that are subcontracted by drilling contractors.

Mud logging involves a chemical analysis of the drilling fluid and cuttings produced in the drilling process for the presence of oil and natural gas. Logging-while-drilling uses sensors located immediately above the drill bit on the drillstring to measure rock and fluid properties in the well as the well is being drilled. The data is then transmitted to the surface for interpretation. If other logging techniques indicate a potential oil or natural gas reservoir, a drillstem test can be utilized for further evaluation. A drillstem test is a temporary completion of the well that involves lowering a drillstem that contains packers, a perforated pipe, pressure gauges and valves at the end of drillpipe into the well.[49] Once the drillstem has been lowered, the packers are expanded to isolate the section of the well which is to be tested. Next, a valve in the drillstem is opened, which allows formation fluids to flow into and up the drillstem and permits testing for the presence of oil and natural gas. The pressure of the formation fluid is also measured, which provides an indication of formation permeability, reservoir fluid pressure and the extent of any formation damage caused while drilling. A drillstem test can take anywhere from 20 minutes to a few days to complete.[50]

For natural gas wells, a flow test may be conducted to measure the flow rate and the pressure of the gas reservoir. This process typically involves flaring of the gas produced from the well.

Once the drilling of a well and testing for the presence of commercially recoverable oil or natural gas reserves has been completed, E&P companies have two choices. First, if commercially recoverable oil or natural gas reserves are not found, or in other words the well is a "dry hole," then the well is abandoned. Abandonment involves plugging the wellbore with cement and reclaiming the site. Second, if commercially recoverable oil or natural gas reserves exist, then completion activities are undertaken. Completion activities are typically provided by companies in the completion and production services subsector of the upstream oilfield services industry.

Environmental Services

The drilling subsector is subject to an extensive regime of environmental regulation that governs the handling, use, storage, removal and treatment of waste, well abandonment and site reclamation. In order to fulfill their environmental obligations, drillers often subcontract environmental service companies. Environmental service companies offer a variety of services in the upstream oilfield services industry and provide drilling contractors with onsite services such as drill cuttings systems and management, drilling waste management, industrial cleaning, spill clean-up, dredging and dewatering, well abandonment and site reclamation.[51] Environmental service companies also assist drillers in the removal, treatment and recycling of drilling waste products, such as drilling fluid.

The Oil Sands

The oil sands present a tremendous opportunity for the drilling and drilling support services subsector of the upstream oilfield services industry. While the oil sands is commonly associated with open pit mining, it is estimated that approximately 80 percent of the proven oil reserves contained in the oil sands are too deep to be economically recovered through surface mining, but are recoverable via *in situ* techniques.[52] In 2015, more than one-half of the crude oil produced from the oil sands was from bitumen that was extracted *in situ*, and drilling and drilling support services – particularly the drilling of horizontal wells – are integral to *in situ* operations.[53] As the future development of the oil sands will increasingly rely on *in situ* recovery techniques, the drilling and drilling support services sector stands to benefit therefrom.

Figure 4: *In Situ* Well Pad

Illustrative Services and Equipment

See Schedule B for a table that illustrates the breadth of service providers and equipment/products found in the drilling and drilling support services subsector.


50

Completion and Production Services

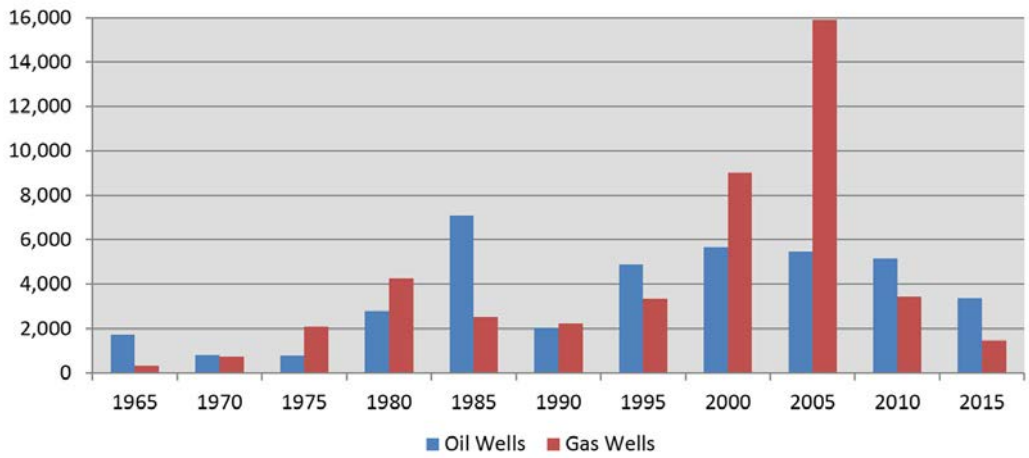
Subsector Overview

Due to the breadth of services provided, the completion and production services subsector is the largest sector in the upstream oilfield services industry. The completion and production services subsector is comprised of the following principal secondary subsectors: (i) completion services – including cementing, tubing and perforation and pressure pumping, and (ii) production services – including well servicing, enhanced oil recovery operations, environmental services and abandonment.

The completion and production services subsector, like the upstream oilfield services industry in general, is subject to the cyclicality, volatility and seasonality that characterize the E&P industry. This subsector is usually the first to benefit when oil or natural gas prices begin to rise, as E&P companies first look to expand production from existing reserves, which is accomplished in two ways. First, E&P companies can increase production from existing wells, which may require the implementation of enhanced oil recovery techniques. Second, E&P companies can drill more development wells into existing reserves. The completion and production services subsector benefits from both of these activities.

As is evident from Figure 5, the total number of oil and natural gas wells completed in Western Canada increased significantly from 1965 to 2005, which benefited the completion and production services subsector. Another trend that is notable is the drastic decline in the number of gas wells completed since 2005 due to significant reductions in natural gas prices. The impact of this reduction on the completion and production services sector has been tempered by the relatively more stable number of oil well completions, although the number of oil well completions has fallen significantly since the downturn in oil prices in late 2014.

Figure 5: Oil and Gas Wells Completed in Western Canada



Source: CAPP Statistical Handbook

The completion and production subsector is generally less volatile than the other subsectors that comprise the upstream oilfield services industry because producing wells, particularly oil wells, require regular service activities to maintain their productive capabilities. Oil wells generally require significantly more maintenance than natural gas wells, for which maintenance requirements are minimal. Once a natural gas well is drilled and producing, a service rig may be required only once or twice over the well's lifetime. For an oil well, a service rig may be required seven or eight times.[54] Currently, there are over 200,000 producing wells in the WCSB.[55]

Due to relatively low barriers to entry in the completion and production services sector, the level of competition is particularly high. Service rigs are generally charged to customers on an hourly basis that fluctuates with the season and industry activity levels.[56] Reduced levels of activity serve to increase competition and reduce revenue. Service rigs also generally operate in close proximity to their home base and, therefore, competition in well-servicing is typically localized.[57]

The completion and production services subsector is also fragmented, with a small number of large players and a large number of smaller players. In the well-servicing subsector for instance, the four largest companies collectively operate almost one-half of the roughly 1,100 service rigs operating in Western Canada.[58]

As with the rest of the upstream oilfield services industry, the completion and production services subsector is highly regulated, particularly with respect to activities that have the potential to adversely affect the environment.

Secondary Subsectors and Activities

Completion Services

Cementing, Tubing and Perforation

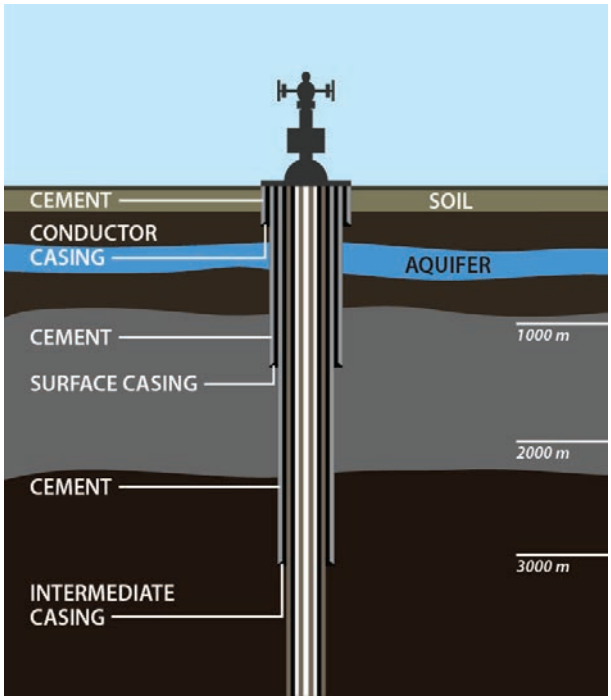
During the drilling process, casing is installed and cemented into place in order to protect the wellbore and the surrounding soil. While drilling contractors may undertake this activity, completion service companies are often hired for this purpose. Completion service companies, as their name suggests, are also involved in the completion of wells, a process that can take anywhere from a couple days to several weeks to finish.[59] The first step involved in completing a well is the installation of production casing. As with all other casing, production casing is cemented into place by pumping cement down the casing where it flows out of the bottom of the string and back up the hole created by the drilling process. Next, a smaller diameter steel pipe known as "production tubing," which provides the flow path for the oil or natural gas from the producing formation to the surface, is strung together and run to the bottom of the wellbore and centered into place. Installation of production tubing is generally done by a service rig.

Traditional production tubing is comprised of sections of pipe which are threaded together. The process of threading the pipe together to reach the bottom of the wellbore is expensive and time consuming. An important innovation in this step of the completion process is coiled tubing, which is a jointless, high-pressure-rated hollow steel cylinder.[60] Coiled tubing, which is brought to the well site in reels holding continuous tubing, is increasingly utilized as a timely and cost-effective means of installing tubing. Regardless of the method used, once the production tubing is in place, it is hung from the surface by the wellhead. The wellhead permits regulation of production from the well, and is often called a "Christmas tree."[61] Next, packers are inserted to isolate the producing formation. Once the producing formation has been isolated, completion fluid, which is typically treated water or diesel fuel, is pumped into the space between the production tubing and the casing. Completion fluid is used to prevent casing or production tubing corrosion.

The next step in the completion process is the perforation of the production tubing, which allows the oil and gas to flow from the formation and up the tubing to the surface. Perforation is typically performed with an explosive device called a "perforating gun," which comprises a collection of explosive charges on a special carrier. The perforating gun is lowered down the well on an electrical wireline or using coiled tubing equipment to the desired depth at which point an electrical impulse detonates the explosive, perforating the production tubing and the surrounding cement, which allows oil or natural gas from the reservoir to flow up the tubing to the surface.

Gas typically flows to the surface as a result of the pressure differential between the wellbore and the producing formation. Most oil wells, however, require the use of artificial lift, which is achieved from a pump. If stimulation techniques are not required to initiate production from the formation, the pump is inserted into the wellbore after perforation. A typical pump system is known as a sucker-rod pumping unit, the ubiquitous "pumpjacks" that scatter the prairie landscape throughout much of the WCSB. This system involves a pump that is lowered down the production tubing on a string of steel rods. The rod string, which is hung from the wellhead and is connected to a motor on the surface, conveys power to the pump by moving up and down. The continuous motion of the pumpjack gradually moves the oil up the production tubing to the surface where it is gathered and enters the midstream sector.

Figure 6: Diagram of Well Casing Placement



Pressure Pumping

For certain formations, particularly those holding unconventional resources such as tight oil or shale gas, further services are required to induce production from the formation. These techniques are known as well stimulation or pressure pumping. The purpose of stimulation techniques is to increase the conductivity of oil or natural gas within a formation in order to increase the flow of oil or natural gas and the ultimate recovery from that formation. Stimulation techniques are increasingly utilized to tap unconventional oil and natural gas reserves, for which the permeability of the producing formation is low.

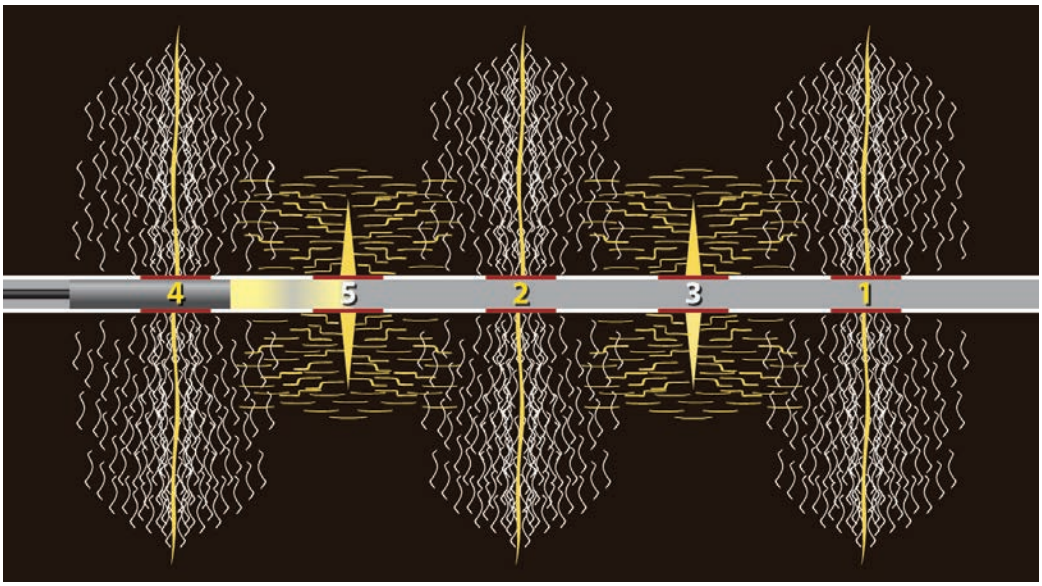
The two most popular forms of stimulation are acidization and hydraulic fracturing. Acidization involves pumping acid down the wellbore in order to dissolve formation particles, which allows more oil to flow freely to the surface. Hydraulic fracturing involves the injection of high pressure frack fluid with suspended "proppants" into the subsurface formation. Sand is one of the most common proppants, and a significant amount of water and sand is used in the fracturing process.

A "frac job" is performed in three steps.[62] First, the frack fluid (typically a proprietary blend of water and chemicals) is injected into the well to initiate fracturing of the targeted formation. Second, a combination of frack fluid and proppants are injected into the well to extend the fractures and fill them with the proppants. Third, the well is "back flushed" to remove the frack fluid.[63] Frack fluid may also be "energized," via the introduction of carbon dioxide or nitrogen gas, in order to reduce formation damage.[64] Hydraulic fracturing involves considerable engineering and geological knowledge and experience to maximize the performance of a well and each frack is individually designed to address the specific temperatures, pressures, formation permeability and reservoir fluids within the producing formation.[65]

The fracking process is very capital intensive and requires multiple pieces of specialized equipment. Coiled tubing is increasingly used in the fracking process as a means to drill out the downhole components involved in multi-stage fracking.

A recent technological advancement in the field of hydraulic fracturing is multi-stage horizontal fracking. Multi-stage horizontal fracking first involves drilling a horizontal well into the targeted formation. Next, a section of the horizontal well is isolated, and fracking of the isolated section is performed. This process is then repeated along the horizontal length of the wellbore. Multi-stage horizontal fracking increases the number of fractures that can be created in a well, which in turn increases the production rate from the producing formation, and is necessary for the commercial production of many unconventional reserves, including shale formations. Today, some operators are fracturing a horizontal well 40-50 times.[66]

Figure 7: Diagram showing a Multi-Stage Horizontal Fracture



Well stimulation is one of the fastest growing segments of the upstream oilfield services industry, and with conventional reserves of oil declining in Western Canada, utilization of fracking, and in particular horizontal multi-stage fracking, is set to increase in the future.[67]

Production Services

Well Servicing

Over the lifetime of a well, certain operations are often necessary to maintain efficient production of oil and natural gas. These services are typically provided by the well-servicing subsector through the use of service rigs. Service rigs, which are often mounted on the back of a truck, are generally smaller and more portable that drilling rigs. While certain routine maintenance activities, such as the maintenance of well power supplies, can be undertaken while the well is still producing, it is usually necessary to cease production, or "shut-in" the well, to perform larger production maintenance operations, which are called "workovers." A producing well is shut-in by a process known as "killing" the well, which involves injecting "killing fluid," such as brine or drilling mud, into the wellbore.[68] After the well is killed, blowout preventers are typically installed to protect the workers from potential blowouts and the well is ready for a workover. Workover activities include blockage prevention, well cleanouts, casing repairs, secondary cementing and swabbing.[69]

Oil is a highly viscous substance and can clog-up production tubing, thereby reducing the flow rate of oil to the surface. In order to combat this problem, well-service companies are typically hired to resolve the clog through the use of heated steam, high pressure water, or, where the temperature is sufficiently cold, ethylene glycol.

Other substances besides oil can also cause production problems that need to be addressed. One example is sand, which can clog the bottom of the well. In order to remove sand, production tubing may have to be removed and replaced with a larger diameter pipe known as a "workstring," through which salt water is pumped into and back out of the well until all the sand is removed.[70] Alternatively, a more efficient method is to use a coiled tubing unit to drill though any such blockage, as this allows the sand to be cleaned out without having to remove the production tubing. Other unwanted substances include salt, corrosive acids and waxes, which can build up on the production tubing. In order to remove these substances, coiled tubing units are often used in conjunction with other equipment to pump nitrogen, air or acid, as required, into the well.[71]

Stress or abrasion can also cause the production tubing to leak, which reduces the amount of production from a well. When this occurs, tubing repairs are necessary, which require the pulling, inspection, repair and reinsertion of the production tubing.

Another issue that can arise is collapsed casing, in which case a casing repair is required. A number of different tools can be utilized depending on the size and location of the particular collapse. Casing holes can also be patched with metal and heavy industrial glues and adhesives.

Secondary cementing is performed where the primary cement job that took place during drilling and completion was inadequate and involves isolation of the problem area with packers, perforation of the casing and pumping cement down the well through the perforations and into the problem area.

Swabbing involves the removal of water or drilling mud from a well.[72] Swabbing is sometimes performed after the well is initially completed, but is typically used as a means to restore production in a producing well.[73] A truck-mounted swabbing unit is utilized to lower a swabbing tool down the wellbore, which is then repeatedly lowered and raised to remove the liquid from the wellbore.

Service rigs are also used to perform well recompletions, which involve abandoning the original producing formation and completing the well in another formation. If the original formation is below the new formation, the well is "plugged back" to the higher zone. If the original formation is above the new formation, the well is drilled deeper.[74] In either case, the original zone is plugged with cement, which can be achieved through a number of different methods.

Enhanced Oil Recovery Operations

As noted earlier, oil is initially recovered from a well via primary recovery techniques, which rely on the natural pressure in the producing formation (either before or after pressure pumping), or mechanical pumps, to get the oil to the surface. However, the average primary recovery rate is only 30-35 percent of the oil contained in the reservoir, and can be as low as 5 percent.[75] In order to increase production from current reserves, enhanced oil recovery techniques need to be utilized.

Enhanced oil recovery encompasses both secondary and tertiary recovery techniques. Secondary recovery techniques involve injecting water (waterflooding) into the producing formation to maintain sufficient pressure for the oil to flow to the surface. Tertiary recovery involves more advanced techniques such thermal, chemical and gas miscible processes.

- Thermal recovery involves the injection of steam into a reservoir via a nearby wellbore, and is utilized to reduce the viscosity of heavy oil to a point where the oil will flow to the surface. The thermal process can recover between 25 to 65 percent of the oil in the reservoir.[76] SAGD is an example of a thermal recovery technique that is increasingly utilized in the oil sands.
- During a chemical flood, various chemical are injected into the depleted reservoir in separate batches which act to push the oil out of the pore spaces in the rock in which it is trapped and toward to the producing well. Chemical floods are expensive, but can recover approximately 40 percent of the remaining oil.[77]
- The gas miscible process, which is the most common tertiary recovery technique, involves the injection of miscible gases, such as carbon dioxide or liquefied natural gas, into the reservoir. Miscible gases dissolve in the oil, making it less viscous and therefore easier to extract. Gas miscible processes can recover up to 35 percent of the oil remaining in the reservoir.[78]

Environmental Services

The environmental services subsector assists E&P companies and other upstream oilfield services companies in complying with the environmental regulations that apply to the production of oil and natural gas, particularly those that deal with waste products. There are a variety of waste products produced by completion and production activities, such as completion fluids, frack fluids, contaminated soil and wastewater. Another common waste product is frack sand, which is used as a proppant in the fracking process. It is estimated that the Canadian fracking sand market uses approximately 3.5 million tons of sand per year.[79] Environmental service companies are engaged in onsite services, product recovery and waste collection, transportation, processing, recycling and disposal.[80] Some environmental service companies also operate landfills for the disposal of waste products or salt cavern disposal facilities that provide a location for disposal of waste that does not satisfy landfill disposal requirements.[81] Environmental service companies also assist in spill prevention, containment activities and cleanups and are contracted by E&P companies to assist in well abandonment and site reclamation and remediation services.

Abandonment

Ultimately, production from a well ceases and the well must be abandoned. Provincial governments in Western Canada regulate the abandonment of wells in order to protect the environment and to promote efficient resource exploitation. In order to comply with these requirements, E&P companies hire production service companies. Abandonment first involves cutting and pulling casing for salvage, if possible. Next, all depleted, producing formations and water reservoirs near the surface are sealed with a combination of plugs and cement. The casing is then cut several feet below the surface and a steel plate is welded on top. Finally, the hole is filled with dirt and a marker is installed on the surface.[82]

Illustrative Services and Equipment

See Schedule C for a table that illustrates the breadth of service providers and equipment/ products found in the completion and production services subsector.

Structuring An Acquisition

General Considerations

The acquisition of a Canadian oilfield services business is generally effected by one of two means: (i) the purchase of assets, or (ii) the purchase of shares. The choice of means will be determined by a variety of factors, including timing, ease of implementation, tax considerations and the liability profile of the target business.

An asset purchase involves the purchase of some or all of the assets owned by an entity and used in carrying on the business of that entity. Assets may include both fixed assets – such as land, buildings and machinery – and intangible assets – such as goodwill, intellectual property and contracts. Usually, the assets are specifically identified in the purchase and sale agreement. Sometimes employee liabilities such as accrued annual and long-service leave are deducted from the asset price or paid out for tax reasons.

Although typically easier to implement, a share purchase carries slightly more risk for a buyer than an asset purchase because the shares come with a range of potential liabilities, many of which may not be identified in the financial statements of the target entity. A purchaser that acquires 100 percent of the shares in an entity takes control of the entity and all of its assets and liabilities. Share sales may involve the sale of the shares in a public or private entity, related entities and occasionally units of a unit trust. In some instances, the share value may be determined on the basis of the expected future earnings of the business and may not take into account the underlying market value of the assets or liabilities being acquired.

Considerations for an Asset Sale

Ability to cherry pick: An asset sale enables the purchaser to choose which assets to acquire and to leave any unwanted assets with the seller. Thus, the purchaser could leave accounts receivable or unwanted inventory with the seller. However, certain liabilities such as environmental contamination associated with real property and a collective agreement relating to unionized employees of the business will flow, by law, to the purchaser in an asset transaction.

Assignment of key contracts: Key contracts may need third-party consent to be assigned or may not be assignable at all, thereby reducing the value of the business to the purchaser. Specific arrangements may be required to vest title in the purchaser. For example, the consent of landlords or finance companies may be required for transfer of any property, plant or equipment leases if these are subject to mortgages or live purchase agreements.

Employees: An employee's current employment contract will usually be with the seller or entities controlled by the seller. When a purchaser buys the assets of a company, the employment relationship cannot be transferred from the seller to the purchaser because employment contracts are personal in nature. In this circumstance, the seller must terminate the employment contract with the employee and the purchaser must enter into a new employment contract with each employee. The seller will need to consider the treatment of the accrued entitlements, which can vary depending on the employment terms and conditions of each employee. Similarly, any employee benefit plans may have to be acquired or assumed, which can be costly in some situations.

Legal: The legal due diligence that the purchaser must conduct in an asset purchase is not as exhaustive as in a share purchase. In an asset purchase, due diligence is generally confined to conducting various searches against the seller to determine whether there are liens or encumbrances against the assets. In addition, the number of representations and warranties given by a seller in an asset purchase can be far less extensive than in a share purchase, since the purchaser specifically identifies which liabilities it is assuming and excludes all others by the terms of the purchase agreement.

Apportionment: In an asset purchase, the purchase price must be apportioned between various classes of assets, including plant and equipment, land and buildings, shares and goodwill, if applicable. This can cause a conflict between a seller's preference to adopt the book value of the assets and a purchaser's preference to adopt a higher value to maximize tax benefits.

Tax consequences: For a purchaser, the cost of assets can be reset to their market value at the time of purchase, which in most instances will reduce the capital gains tax that might otherwise arise at a future date and result in a benefit to the purchaser. Further, a purchaser will usually want to allocate as much of the purchase price as possible to depreciable property with the highest depreciation rate so that it can "step up" the value of these assets to their fair market value, resulting in higher tax deductions for depreciation in the future. A seller, on the other hand, will usually want the purchase price allocated to classes of assets that have already been depreciated to minimize the recapture of capital cost allowance previously deducted on depreciable property. A seller might also gain a benefit by utilizing tax losses to offset other tax liabilities arising from the sale.

Goods and services tax (GST): When all the assets of a business are transferred, the sale may be classified as the sale of a going concern. This may result in no GST being payable on the transaction. Alternatively, when the sale cannot be categorized as a going concern, a GST liability may arise. However, in most cases, the purchaser will be entitled to claim back any GST paid on an acquisition of assets as an input tax credit.

Considerations for a Share Sale

Continuity of business name: The business is carried on by the same entity, with the purchaser stepping into the shoes of the seller and thereby reducing the need for costly and time-consuming administrative matters relating to a change of name. In some instances, customers may not even realize that a change of ownership has taken place.

Employees: Employees usually remain with the entity and accordingly, with the purchaser. The legal identity of the employer remains the same, apart from possible provisions in the purchase and sale agreement that may provide for redundancy of specific staff or for specific benefits to be paid upon a change of control of the business.

Assignment: Prohibitions against assignment in agreements may not arise because the contracting party remains the same. This means that it may be easier to sell the shares of an entity with desirable contracts, rather than reassigning or novating a large number of contracts or licences. However, reviewing the terms of these agreements is still important because they often include change of control clauses that may have implications for the new purchaser.

Tax consequences: There may be more flexibility in a share sale to structure the transaction to optimize the after-tax outcome for the seller. The sale will generally give rise to a capital gain for the seller, of which only 50 percent is taxable. The seller may be able to offset the capital gain on the sale with available capital losses to decrease the tax burden. In addition, a seller who is an individual resident in Canada may be able to use the lifetime capital gains exemption (currently $824,176) to shelter all or a portion of the gain arising from the sale of the shares.

Unrecorded liabilities: These include tax and environmental liabilities or warranties that the purchaser may not know about. It is important to ensure that tax, legal and accounting due diligence is undertaken to identify these liabilities.

Representations and Warranties: The purchaser will need to ensure that it obtains relevant representations and warranties from the seller to avoid being left with unresolved liabilities such as unpaid fringe benefit tax or payroll tax.

Public companies: The acquisition of shares of a public company could trigger the application of the takeover bid requirements of Canadian corporate and securities legislation. The threshold for a takeover bid is generally 20 percent of the issued voting shares or equity shares (essentially non-voting common shares) of any class or series of the issuer. A purchase resulting in a holding of less than 20 percent of the relevant class of shares will not constitute a takeover bid, even if the bidder obtains effective control of the company. Conversely, any purchase beyond the 20 percent level will be a takeover bid, even if there is no change in control. Under the early warning rules of Canadian securities legislation, disclosure is required of an acquisition of 10 percent or more of the voting or equity shares of a company (or securities convertible into voting or equity securities), and subsequent acquisitions and dispositions of 2 percent or more within the 10 to 20 percent range.

Mutual Considerations

Whether or not the transaction is structured as an asset purchase or a share purchase, the parties must ensure that they have undertaken sufficient due diligence. Furthermore, the determination of the purchaser's preferred vehicle for carrying on the future business will require specific tax and related asset protection/succession advice.

Federal Regulatory Approvals

An investment in the oilfield services industry, regardless of the sector or subsector, may be subject to Federal regulatory approvals, of which the following three are the most common.

The *Investment Canada Act*

The *Investment Canada Act* applies to foreign investments to acquire control of a Canadian business, establish a new Canadian business or acquire an interest in a Canadian business when such acquisition may be "injurious to national security".

The Minister of Innovation, Science and Economic Development reviews "acquisitions of control" by non-Canadian investors of businesses in Canada when the acquisition value exceeds specified financial thresholds. An acquisition of more than one-third of the voting shares of a corporation or of all or substantially all of the assets of a business (including a business unit) may constitute an acquisition of control.

A "direct" acquisition by a non-Canadian will be subject to review if the enterprise value of the Canadian business exceeds $600 million. An "indirect" acquisition by a non-Canadian that is a World Trade Organization (WTO) investor and involves an acquisition of a non-Canadian corporation that has a Canadian subsidiary is generally not reviewable. Acquisitions by entities that are controlled by state-owned enterprises or non-WTO investors are subject to lower financial thresholds and additional specific guidelines.

In an effort to increase foreign investment in Canada, the Federal Government announced in November 2016 its intention to increase the current $600 million "enterprise value" review threshold to $1 billion. As a result of this increase, fewer transactions will be subject to review under the *Investment Canada Act*.

If the transaction is subject to review, the parties may not close the investment until the Minister has approved the investment on the basis that it will be of "net benefit" to Canada. This process usually takes 45 to 75 days, depending upon the complexity of any identified issues.

If the financial thresholds are not reached, an acquisition of control of a business in Canada by a non-Canadian will be subject only to a post-closing notification filing, unless the acquisition raises "national security" concerns — which is highly unlikely in respect of acquisitions involving the oilfield services industry.

The *Competition Act*

The *Competition Act* permits the Commissioner of Competition to review any merger, acquisition or investment to assess the impact on competition resulting from the transaction. The Competition Tribunal, on application of the Commissioner, may make an order to block or make other remedial orders in respect of mergers, acquisitions or investments that are determined to prevent or lessen competition substantially.

In addition, under the *Competition Act*, certain acquisitions (including the acquisition of 20 percent of the voting shares of a public corporation or 35 percent of the voting shares of a private corporation) and strategic alliances may be subject to pre-merger notification when certain financial thresholds are reached. The financial threshold tests include: (i) size-of-the-transaction test: the aggregate value of the assets in Canada to be acquired exceeds $87 million, or the gross revenues from sales in or from Canada generally from these assets exceed $87 million (these thresholds are adjusted annually); and (ii) size-of-parties test: the parties (together with their affiliates) have assets in Canada that exceed $400 million in aggregate value or had gross revenues from sales in, from or into Canada that exceed $400 million, all as set forth in the parties' most recently completed audited financial statements.

If the transaction is subject to pre-merger notification, the parties must file a notification with the Commissioner and not close the transaction until expiry or early termination of a statutory waiting period, which is initially a 30-day waiting period. The filing fee for a pre-merger notification under the *Competition Act* is $50,000.

The *Canada Transportation Act*

Under the *Canada Transportation Act* (CTA), every person required to file a pre-merger notification under the *Competition Act* of a proposed investment that "involves a transportation undertaking" must give notice of the investment to the Minister of Transportation. If the oilfield services business to be acquired provides some form of transportation services to third parties (including customers), such as trucking or rail across provincial borders or the Canada-U.S. border, that business may involve a transportation undertaking and thus may be subject to the CTA. If the transaction is subject to review, the parties may not close the investment until the Minister of Transportation has approved it as being in the public interest as it relates to national transportation. That process takes approximately 42 days. The review process under the CTA is typically straightforward, and it is unlikely that the acquisition of an oilfield services business would raise national transportation concerns.

Environmental Policy and Regulations

The oil and natural gas industry in Western Canada is highly regulated, and the oilfield services industry is no exception. Upstream oilfield services companies are subject to a variety of federal, provincial and municipal laws, including laws relating to health and safety, the conduct of operations, the operation of equipment, protection of the environment and the manufacture, management, transportation, storage and disposal of certain materials.[83]

Environmental laws vary by jurisdiction, but generally address waste generation, recycling and management facilities, water and wastewater treatment, reclamation and recovery activities, air emissions, groundwater protection, surface water management and liability for contamination and soil protection.[84]

Federal and provincial policies regarding GHG emissions also affect the upstream oilfield services industry. Climate change has become entrenched in the political discourse and, as of December 2015, Canada reached a non-binding climate change agreement with the other 194 countries that took part in the United Nations Climate Change Conference in Paris, France. The Paris Agreement's primary goal is to limit the increase in global temperature to well below 2 degrees Celsius above pre-industrial levels. Federal policies to implement the means by which this goal is to be achieved have yet to be enacted. On the provincial level though, Alberta has implemented a regime to encourage major emitters to reduce the intensity of GHG emissions. The regime is governed by the *Specified Gas Emitters Regulation* (SGER) under the *Climate Change and Emissions Management Act*, which imposes a $15/tonne price on CO2-equivalent emissions from eligible emitters. The Alberta government recently passed the *Climate Leadership Implementation Act* (CLIA), which will replace SGER by 2018 with an Alberta economy-wide carbon levy on various types of fuel, at a rate of $20/tonne starting in 2017 and rising to $30/tonne in 2018, with annual increases thereafter.

Generally, the carbon levy is to be applied when fuel is imported into Alberta, sold within Alberta, removed from oil and gas–related infrastructure (e.g., a refinery, terminal, gathering system or processing plant) within Alberta, or flared or vented in Alberta. The person responsible for paying, collecting or remitting the carbon levy depends on the type of fuel and its use. Typically, persons who deal in bulk fuel, such as purchasers of fuel at refineries or terminals, importers of fuel into Alberta or natural gas distributors will be obligated to remit the carbon levy. The CLIA provides mechanisms, through either exemption licences or refunds, to permit fuel to move through the supply chain without incurring multiple incidences of the carbon levy.

In addition, and as part of Alberta's *Climate Leadership Plan*, the government introduced a cap of 100 megatonnes on GHG emissions from oil sands operations, subject to certain exceptions for co-generation power sources and new upgrading capacity. The oil sands sector currently emits approximately 70 megatonnes per year. The Alberta government also introduced a 45 percent reduction target in methane emissions from oil and gas operations by 2025. This target is intended to be achieved through emissions design standards for new oil and gas facilities and regulated mandatory standards for existing facilities effective in 2020.

All other provinces in Canada also place a tax on carbon-based fuels. The price per tonne varies for each jurisdiction, but in all cases is expected to rise incrementally over the next decade.

In addition, in September 2016, the Federal government announced its intention to implement a nation wide price on the emission of carbon dioxide that will be imposed upon provinces who do not establish their own levies, or whose levies are not in compliance with the federally prescribed amounts. Currently the Federal government's plan calls for a national price of $10/tonne beginning in 2018 rising to $50/tonne in 2022.

Current Issues Affecting the Industry

Oil and Natural Gas Prices

Due to an abundance of supply, oil and natural gas prices remain low and, with recent major unconventional discoveries in North America, are projected to remain that way for the foreseeable future. Low oil and natural gas prices have correspondingly created poor short-term conditions in the oil and natural gas industry, resulting in significant decreases in capital expenditure and activity. Activity levels in the upstream oilfield services industry, which are heavily reliant on capital expenditures by oil and natural gas producers, have consequently been adversely affected. Companies in the upstream oilfield services industry have therefore had to consolidate, cut their costs, and gain new efficiencies, which actions should position the industry well when oil and natural gas prices recover.

Access to Capital

The new "lower-for-longer" price environment, combined with increased economic uncertainty and volatility, has restricted access to capital and increased borrowing costs for both companies in the upstream oilfield services industry and their customers. For these companies to maintain existing assets, make capital expenditures and fund growth strategies, they will need to be able to acquire credit facilities on reasonable terms or to obtain financing through equity or debt markets. If that financing cannot be obtained or can be obtained only at a higher cost, the level of activity in the upstream oilfield services industry will be adversely affected.

U.S. Oil and Shale Gas Boom

The development and implementation of horizontal drilling and hydraulic fracturing techniques have led to a boom in the production of unconventional oil and shale gas in the United States. According to the U.S. Energy Information Administration, the United States has become the world's largest producer of petroleum and other hydrocarbons for the first time in over a decade.[85] The drastic increase in oil production has led to the removal of a 40-year ban on oil exports from the United States and has even sparked discussions of U.S. oil independence, which could occur as early as 2035.[86] It is yet to be seen, however, whether unconventional oil and shale gas will be the panacea that some predict, particularly given evidence of a high depletion rate for shale oil reservoirs. Nonetheless, with the United States as the primary export destination for Canadian oil, the U.S. oil boom has the potential to significantly affect the oil industry in Canada. While the United States is likely to remain a significant destination for Canadian oil for the foreseeable future, the future success of the Canadian oil industry, including the upstream oilfield services industry, may be largely dependent on accessing additional foreign markets, such as Asia, which in turn depends on the success of major pipeline projects.

Pipeline Capacity and Market Access

As a major exporter of crude oil, the Canadian oil and natural gas industry depends on its ability to transport hydrocarbons to foreign markets. Transmission pipelines, the main arteries in the circulatory system of the western Canadian oil industry, are therefore vital to the industry's success. The existing transmission pipeline network in Western Canada is currently capable of transporting 3.5 million barrels per day.[87] Exports of crude oil and natural gas liquids reached 3.2 million barrels per day in 2015,[88] resulting in the existing pipeline capacity becoming almost fully utilized. With future production and exports expected to increase, the success of the Canadian oil and natural gas industry is closely tied to expanding pipeline capacity.

Currently, a number of proposed projects aim to ease pipeline capacity constraints and/or access to the United States and overseas markets. These include the Northern Gateway Pipeline, the Keystone XL Pipeline, the Kinder Morgan Trans Mountain Expansion and the TransCanada Energy East Pipeline. If these pipelines are built, together they will have the capacity to transport about another 3 million barrels per day.[89] The Northern Gateway Pipeline and the Keystone XL Pipeline, which together could transport up to 1.7 million barrels per day, have faced steep opposition, however, and it will be several years before any of these pipelines become operational, if at all.

According to the Conference Board of Canada, uncertainty over these projects poses a threat to upstream oilfield services companies because uncertainty may lead producers to pull back their investment plans.[90] Changes in federal policy may pose additional barriers to pipeline approvals and further delay the pipeline approval process — for example, the federal cabinet, in determining whether a proposed pipeline is in the national interest, may factor in the impacts of proposed pipelines on upstream GHG emissions. Foreign investment in the oil patch may be adversely affected by uncertainty regarding future pipeline development.

Conclusion

It is our belief that the following fundamentals provide a compelling business case for investors in the upstream oilfield services industry in Western Canada:

- An industry that is an indispensable part of the oil and natural gas industry in Western Canada.
- An industry whose customers are developing a substantial resource base from which overall production is forecast to be stable or increasing in the long term.
- A shift toward extraction of unconventional resources, which will increasingly require the specialized service of the industry.
- An industry that is a world leader in innovation and technical expertise in the global oil and natural gas industry.
- An indusrty that has access to a highly educated labour pool.
- A stable political environment with well-developed, sophisticated and continually improving legal and regulatory regimes.

Investors are advised to seek legal advice early in their strategizing from legal counsel with extensive experience in upstream oilfield services transactions. Bennett Jones LLP has played an integral role in the Canadian oil and natural gas industry for nearly 90 years and has extensive contacts throughout the industry. We are happy to answer questions from prospective investors.

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Schedule A

Geophysical Services

Illustrative Services and Equipment

While not exhaustive, the below table illustrates the breadth of service providers and equipment/products found in this subsector:

Service Providers	Equipment and Products
Acoustics	Air Drilling Equipment
Aerial Surveys/Photographs	All Terrain Vehicles
Blasting	Batteries & Standby Power Systems
Camp – Rentals, Services, Supplies	Communication Systems & Equipment
Consultants – Acoustical, Geological, Geophysical, Land, Computer, Environmental	Computer Aided Interpretation Systems
Coring	Data Processing Systems Equipment & Supplies
Data Collection and Management	Drilling Equipment
Earth Moving	Environmental Monitoring Equipment
Geological	Explosives
Hydrogeological	Generators – Diesel & Electric
Information Processing	Helicopters
Land Clearing & Leveling	Instrumentation
Lease Brokers & Land Agents	Maps
Mapping	Modeling Systems/ Oil & Gas Software
Reclamation	Portable Offices/Accommodations
Remote Sensing	Recording Instruments
Road Building	Road Building/Maintenance Equipment
Safety Supervision	Satellite Receiving Equipment
Seismic Acquisition	Seismic Rigs
Seismic – Data Brokers, Data Processors	Shock Tools
Seismic Drilling	Surveying Instruments
Surveyors & Surveying	Track Excavators
Transportation	Vibrator Trucks
Vegetation Control	

Schedule B

Drilling and Drilling Support Services

Illustrative Services and Equipment

While not exhaustive, the below table illustrates the breadth of service providers and equipment/products found in this subsector:

Service Providers	Equipment and Products
Aggregates	Air Compressors
Blowout Prevention	Backhoes
Camp – Rentals, Services, Supplies	Batteries & Standby Power Systems
Cementing	Blowout Preventers & Controls
Cleaning – Pressure, Chemical, Etc.	Boilers
Consultants – Drilling, Engineering, Oilfield, Road Building, Water	Compressor Packages
Coring	Concrete & Concrete Products
Crane	Construction Materials
Crude Oil Hauling	Containment Systems
Dewatering	Control Systems & Regulatory Equipment
Drilling Contractors	Desanders & Desilters
Drilling Equipment – Service & Repairs	Dewaxing Equipment
Drilling Inspection	Directional Drilling Equipment
Electrical Contractors	Downhole Motors & Tools
Emissions Monitoring	Drill Bits, Collars & Pipes
Environmental	Drilling Fluid & Fluids Chemicals
Equipment Hauling	Environmental Products
Excavating & Earth Moving	Fences & Fencing Materials
Groundwater Monitoring	Filters
Hazardous Goods – Transportation & Disposal	Fishing Tools
Hydro-vac	Flow Measuring Equipment
Logging	Fuel Tanks
Marketers of Oil, Gas, Power & Related Products	Generators
Oil & Gas Wireline	Heating Equipment & Supplies
Reclamation	Heavy Trucks Sales & Rentals
Rigs – Repairs & Services	Hydraulic Equipment & Supplies
Road Building	Instrumentation – Industrial & Scientific
Separating & Metering Solutions	Lighting Systems & Equipment
Underbalanced Drilling	Lubricants & Lubricating Equipment
Waste Management	Mats
Wastewater Treatment	Motors
Waterhauling	Packers & Packing Materials
	Pipe & Collars
	Portable Accommodations
	Power Tongs
	Rig Mats
	Rigs
	Road Building & Maintenance Equipment
	Sand & Gravel
	Surface Casing
	Tanks
	Ultrasonic Equipment & Supplies
	Vacuum Equipment & Systems
	Valves & Fittings
	Water Treatment & Purification Equipment

Schedule C

Completion and Production Services

Illustrative Services and Equipment

While not exhaustive, the below table illustrates the breadth of service providers and equipment/products found in this subsector:

Service Providers	Equipment and Products
Acidizing	Bits
Cementing	Casing
Chemical Treating	Cementing Equipment & Tools
Coiled Tubing	Chemical Injectors
Corrosion Control & Protection	Coiled Tubing Units
Dewatering	Compressor Packages
Environmental	Concrete & Concrete Products
Fracking	Control Systems & Regulatory Equipment
Gas Handling/ Storage	Dehydrators
Hazardous Goods – Transportation & Disposal	Dewaxing Equipment
Heavy Equipment Hauling	Downhole Motors
Logging	Downhole Oil Tools
Perforating	Downhole Pumps
Pressure Pumping	Environmental Monitoring Equipment
Pressure Testing	Fishing Tools
Production	Flow Measuring Equipment
Pumpjack Maintenance & Repair	Frack Fluids
Reclamation	Hydraulic Equipment & Supplies
Service Rigs – Repairs & Services	Nitrogen Generation Units
Steam Cleaning	Packers
Swabbing	Packing Materials
Trucking – Liquid & Bulk	Pumps & Pumpjacks
Turnaround	Sand
Vacuum & Tank Truck Services	Service Rigs
Waste Management	Tank Trucks
Water Hauling	Tanks
Well Abandonments	Vacuum Equipment & Services
	Valves & Fittings
	Wellhead Equipment & Rentals
	Wireline - Equipment, Manufacturers
	Wire & Cable

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