



Petroleum  
Human Resources  
Council of Canada

Conseil canadien des  
ressources humaines  
de l'industrie du pétrole

## Strategic Human Resources Study of the Upstream Petroleum Industry:

# THE DECADE AHEAD



**Canada**

Funded by the Government of  
Canada's Sector Council Program.



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Human Resources  
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de l'industrie du pétrole

Dear Reader,

The Petroleum Human Resources Council of Canada (Petroleum Council) is pleased to publish this *Strategic Human Resources Study of the Upstream Petroleum Industry: The Decade Ahead* final report. The report is the result of 10 months of research into the human resources issues of the upstream petroleum industry throughout Canada. It is written for a variety of stakeholders, including industry, government, education and training providers and diversity-serving agencies.

Through this study, the Petroleum Council sought to identify:

- workforce demographics, skills, supply and demand;
- key human resources challenges of the industry; and
- the impact of technology and the business environment on human resources issues.

The report not only presents a picture of the human resources issues of the coming decade but also provides a strong foundation on which to build a human resources plan for the industry. This would not have been possible without the volunteer Steering Committee who represented our stakeholders. Their dedication to the study was unparalleled.

We committed to soliciting feedback from our stakeholders on our recommended human resources priorities prior to acting on them. By engaging our stakeholders directly, we are able to address the study findings, discuss the initiatives and projects that are proposed as priorities, and gain feedback on priorities – all through a series of stakeholder meetings across the country. Subsequently, the Petroleum Council will define a human resources plan for the industry that addresses critical issues and builds a platform for future industry growth and sustainable, attractive employment.

I invite you to visit the Petroleum Council website at [www.petrohrsc.ca](http://www.petrohrsc.ca) for regular updates.

Yours sincerely,

Cheryl M. Knight  
Executive Director & CEO

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Published October 2003 and updated in 2004

# Canada

*The Strategic Human Resources Study of the Upstream Petroleum Industry: The Decade Ahead* was funded by the Government of Canada's Sector Council Program.

## **Acknowledgements**

The success of the *Strategic Human Resources Study of the Upstream Petroleum Industry: The Decade Ahead* is the result of assistance from many contributors and dedicated volunteers. The Petroleum Human Resources Council (Petroleum Council) of Canada gratefully acknowledges all the individuals and companies who generously contributed their time or resources to the study. The Petroleum Council is especially thankful to the Steering Committee who guided the study and to the Integration Sub-committee who reviewed and provided feedback on the research modules and the final report.

The Petroleum Council is also grateful for the funding support of the Government of Canada's Sector Council Program. HRDC's contributions were augmented with contributions from industry and other stakeholders.

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A special thank you to Shannon Campbell, Roger Gunn, Lynn Lehr, Robin Wortman and Devra Yanke.

The Petroleum Council extends heartfelt thanks to those from industry, education, government and diversity groups who took time to participate in interviews, focus groups and surveys. Without their contributions, this report would not have been possible. Many thanks to the Regional Issues Working Group (Fort McMurray), the Petroleum Industry Human Resources Committee (St. John's), Petroleum Research Atlantic Canada (Halifax and St. John's) and the Mackenzie Valley Producers Group (Northwest Territories) for significant contributions of information and time.

A special thank you is extended to Pat Hufnagel-Smith, Creative Links, for her efforts and hours of dedication as study project manager.

The Petroleum Council also acknowledges the consultants who conducted the study under the guidance of the Steering Committee:

The team at Towers Perrin, a human resources consulting firm, was led by Robert Tarvydas and Catherine Shepherd.

The team at Ziff Energy Group, an energy consulting firm, was comprised of Gord Masiuk, Paul Ziff, Bob Reid, Ken Becker, Gordon Clarke, Court Mackid, Bill Gwozd, Simon Mauger and Rick DeWolf.

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## **EXECUTIVE SUMMARY**

This report documents a national study of human resources within the Canadian upstream oil and natural gas industry during the next 10 years.

Restructuring of the upstream petroleum industry has taken place in response to global economic change and the evolution of North American energy markets. One result is the concentration of assets in large companies. In fact, Canada now has few medium-sized active “explorers” of the kind that used to drive drilling activity. Junior companies and the few remaining medium-sized companies tend to build up assets and then sell to the royalty trusts. This has been the typical business model of recent years, one with profound implications for human resources.

This study, directed by the Petroleum Human Resources Council of Canada (Petroleum Council) and conducted by independent consultants, considered the role of Canada’s upstream petroleum industry within the global marketplace, analyzed current and future market challenges, and assessed their impact on the domestic industry and its workforce. It then identified workforce demographics, skill and competency requirements, occupational supply and demand, key human resources challenges, and the impact of technology and the business environment on human resources issues. That analysis led to recommendations for change to existing human resources strategies and practices within the industry.

### **Scope**

Traditional definitions of the petroleum industry include three sectors: upstream (E&P), midstream (processing, storage, large-diameter and small-diameter pipeline transportation), and downstream (refining and marketing). For the purposes of this report, we have defined the upstream industry broadly to include:

- Exploration and Production (E&P)
- Service Industries
  - Geophysical services
  - Drilling and completions
  - Service companies
- Pipeline Transmission
- Natural Gas Processing
- Heavy Oil and Bitumen Extracting and Upgrading

Direct employment by these sectors stands at 120,040 jobs, while the total (direct and indirect) employment impact is estimated at more than 500,000 positions.

Geographically, the study defined four main upstream oil and gas regions in Canada:

- Western Canada Sedimentary Basin (WCSB)
  - Alberta, northwestern Saskatchewan, northeastern British Columbia and parts of Manitoba, the Northwest Territories and the Yukon Territory;
- Oil Sands
  - primarily situated in northeastern Alberta and northwestern Saskatchewan;
- North
  - the Mackenzie Delta, Beaufort Sea Offshore, and onshore areas in northern portions of the Northwest Territories; and



- East Coast
  - the offshore areas under the jurisdiction of Nova Scotia and Newfoundland and Labrador.

The industry also operates in Central Canada, where all sectors are represented to some degree.

Quebec does not have current production, but it does have mainline oil and natural gas pipelines. There is also some exploration interest. As most of this exploration is in the eastern portion of the province and linked geologically to exploration efforts on the East Coast, this report's analysis of the East Coast is also relevant to Quebec.

Ontario, which has produced petroleum continuously since 1858, now accounts for less than one per cent of the national total but provides more than half of Canada's natural gas storage capacity. The skills needed to find and exploit natural gas storage structures are virtually identical to those of the conventional petroleum exploration and extraction industries. Like Quebec, Ontario also has mainline oil and natural gas pipelines. While the Ontario industry is farther along the life cycle curve than the WCSB, almost all of the human resources issues related to the mature WCSB basin are directly relevant to Ontario. Therefore, this report's analysis and discussion of the WCSB can be applied directly to Ontario.

Supply/demand analyses were completed for "in-scope" occupations (see Appendix B), as determined by a group of industry stakeholders. Because construction for upstream industry projects was defined as being outside the scope of the study, related occupations were not analyzed from a supply/demand perspective. However, the pressure of significant oil and gas and other industry construction on related operations and maintenance occupations within the upstream sector was considered.

### **Key Industry Influences and Effects on Human Resources**

Managing the supply of qualified human resources is critical to the industry's ability to sustain itself and grow. The main influences on its management practices are:

- Globalization and the mobility of investment capital;
- Cyclical economic conditions;
- Operational excellence business model;
- Government regulatory requirements;
- Stakeholder expectations for involvement;
- Technological advances;
- Changing demographics; and
- Workplace skills.

All of these influences affect industry's ability to attract, retain and deploy a skilled workforce. It is important to note that while these issues affect the industry nationally, their impact varies regionally.

## **Regional Scenarios**

The report discusses high and low case scenarios for each region over a 10-year period. These forecast industry activity and its impact on human resources. A summary follows for each region.

### **WCSB**

The conventional upstream petroleum industry is in the maturity/harvest stage of its life cycle. As it matures, it places greater emphasis on cost reduction and production enhancement as ways of delivering acceptable shareholder returns. Advancements in technology are also expected to improve efficiency.

As production and reserves diminish, the industry looks increasingly to tight gas, coal bed methane and deep gas to replace declining conventional resources. Enhanced recovery of conventional assets will be important until such time as technologies are developed that allow new forms of the resource to be extracted and processed cost-effectively.

Fewer jobs will be required under either scenario. Outsourcing of non-core work will continue, as shown by research and development migrating to the service companies and the contracting out of maintenance work. As the industry leverages information technology (IT), the scope of some jobs will broaden.

Despite a projected decrease in overall labour demand during the next 10 years, certain skills are likely to be in short supply. The industry can balance labour supply and demand better by implementing programs that keep mature workers in place longer while ensuring that sufficient new hires are made to sustain occupational families. With respect to all but a few occupations, retirement of skilled workers will not be an issue in this decade. That gives industry time to prepare for this demographic shift.

### **Oil Sands**

Growth is the driving factor in the Oil Sands region. Production under the high case scenario is expected to increase by 100 per cent in the next 10 years. Even under the low case scenario, production is expected to increase by 50 per cent before stabilizing during this period.

Consequently, demand for labour will be high. An estimated 8,000 new positions will be created during the next 10 years. Attrition due to age will also affect the supply of and demand for labour.

Ongoing cost pressures and the entry of new Oil Sands developers may have a further impact on human resources. A collaborative approach to managing growth will be needed so that enough new employees can be attracted. Without collaborative efforts, the result will be significant upward pressure on labour costs.

## **North**

The North is in the startup phase of the industry life cycle. Under the high case scenario, a Mackenzie Valley natural gas pipeline could be operating by 2008/2009. Approximately 50 people would be required to operate the entire system; some 200 more would be required to operate the producing fields.

Attracting and retaining workers will be the challenge due to remoteness and climatic conditions.

Minimizing the “boom-and-bust” economic impact for the region will be a key area of focus for industry and local communities, as well as a means of ensuring employment for Aboriginal Peoples.

Increasingly, Aboriginal Peoples have been able to find sustainable employment by developing careers and businesses through service companies that support exploration and production activity. This represents a best practice for enhancing the participation of Aboriginal Peoples in the industry.

## **East Coast**

The East Coast industry, which is in the mid- to late-startup phase, could have a significant economic impact on Atlantic Canada. Drilling success must be demonstrated soon, however, if further development is to occur. The need to streamline the complex regional regulatory process is recognized and underway.

The scale of the East Coast industry is pivotal to human resources issues. The industry has not reached the point where it can absorb enough new employees to build a sustainable talent pool. Many new graduates will need to seek employment outside of the region as relevant employment is not yet available locally. There is also a shortage of workers with offshore experience.

The industry is made up of three categories of workers: "personnel on board" or those who work offshore on a rotational shift, onshore-based workers who travel offshore as required, and those who only work onshore. The issues of climate and remoteness apply to the work on offshore platforms or other vessels.

Under the high case scenario, a fourfold increase in gas production is possible. Newfoundland oil production will be roughly one-third of the Canadian light oil production once the White Rose field comes into production. If such positive changes occur, demand for staff with critical skills and experience will be high in the region. A specific East Coast strategy for attracting, supporting, training and developing workers is needed.

## **Industry Overview**

As the competitive environment changes and as corporations reduce costs to improve performance, it will become increasingly difficult to attract workers with critical skills. This may be rectified, in part, by creating and sustaining a positive image of the industry as a desirable place to work.

Like many other industries, the industry will continue to restructure in response to competitive pressures and commodity price fluctuations. While the industry must respond to the economic

and business environment to remain viable, industry leaders should consider the longer term impact of some of these decisions on human resources in the light of the challenge of attracting and retaining skilled workers.

## **Themes**

A 1992 industry study<sup>1</sup> discussed challenges the industry would likely face in human resources during the subsequent decade. As substantive, industry-wide solutions have not materialized during the intervening years, many of those challenges remain.

This study identified four over-arching themes that capture the approach industry must adopt if it is to thrive:

### **Theme 1: Collaboration**

There is a pronounced need for co-ordination and collaboration among industry associations, all levels of government, educational institutions, private training service providers, unions, and industry.

### **Theme 2: Excellence**

Company leaders and human resources professionals must adopt best practices that allow companies to attract talented individuals, retain them at challenging remote locations, and facilitate their movement from one region to another.

### **Theme 3: Sustainability**

To grow and prosper, industry must have access to vital resources when it needs them. Those resources take many forms, including natural resources, innovative technology, investment capital, and human resources. The sustainability of the industry therefore depends, in part, on the identification and resolution of human resources challenges.

### **Theme 4: Optimization**

Industry optimization must be a proactive, long-term strategy. Optimization means maximizing profit, leveraging technology to improve efficiency and automate labour-intensive processes, and possessing the right people at the right time for the jobs at hand.

## **Key Human Resource Issues**

Seven key human resource issues need to be addressed:

### **1. Promoting Careers in the Industry**

Attracting new employees into the industry is critical to getting the right skills to the right region when they are needed. New entrants in some key occupations are needed to ensure that expected labour demand can be met under economic scenarios.

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<sup>1</sup> Human Resources in the Upstream Oil & Gas Industry, Human Resources Development Canada, September, 1992.

## **2. Access to Non-traditional Workforce**

The industry is under-utilizing potential sources of labour including women, Aboriginal Peoples, and new immigrants. These groups face barriers to entry into the upstream petroleum industry. These barriers must be addressed if under-utilized individuals are to become a ready source of additional labour.

## **3. Skills Shortages**

There are skill shortages in a number of occupational areas already, or will be soon. The current shortage of trades workers will be worsened by demanding construction cycles in both the oil and gas industry and other industries. A critical shortage of heavy equipment operators, process operators, heavy duty mechanics and power engineers will occur with the growth of the Oil Sands. The industry currently experiences shortages of workers in drilling and in the seismic and service sectors. “Hot skills” continue to materialize in skilled and professional occupations and must be addressed more creatively than in the past.

## **4. Labour Market Information Gaps**

East Coast, Oil Sands and the North have completed labour demand forecasting, but there is no comparable labour market data for the WCSB. This affects industry’s ability to complete regular, industry-wide forecasting of labour supply/demand. Access to such information would allow educational programs to align better with industry needs. It would also facilitate analysis of high demand occupational risks so industry could respond with strategies that alleviate the pressure of an aging population.

## **5. Shifting Skill Requirements**

Composition and competency requirements of positions will change in response to changes in business, the regulatory environment, and technology. Firms with few or no designated training personnel are particularly challenged to support their employees in making those transitions.

## **6. Mobility of Workforce**

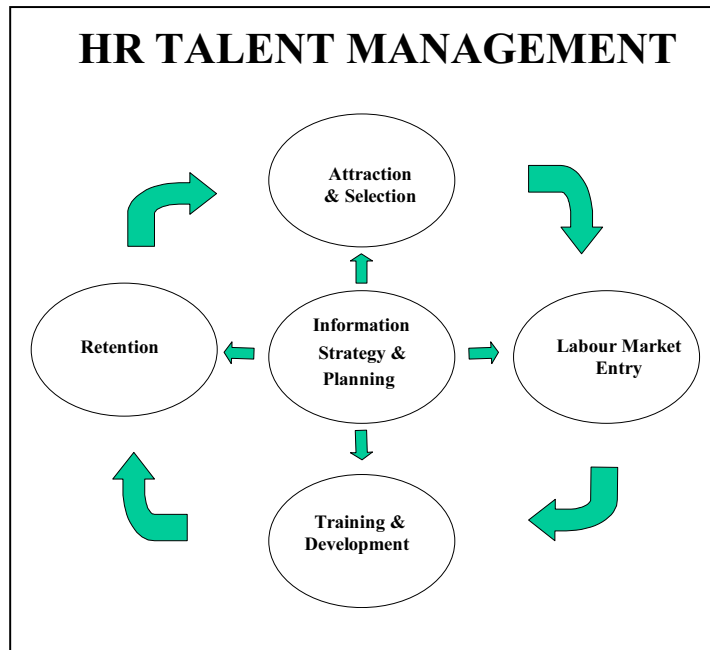
The mobility of employees will be a key factor in getting the right skills to the right regions when they are needed.

## **7. Creative Human Resources Practices**

The oil and gas industry has traditionally responded to labour shortages or other human resources pressures with competitive compensation programs. The industry will need more creative solutions to employee attraction and retention.

## **Summary of Recommendations**

The following summary of recommendations is linked to the key challenges and practices needed to manage human resources, as shown in the following schematic. This is the Human Resources Talent Management model developed as part of the study. Each element of the model is explained later in the report.



		<b>HUMAN RESOURCES TALENT MANAGEMENT MODEL PRIORITY</b>	
		<b>Information, Strategy and Planning</b>	<b>Labour Market Entry</b>
<b>KEY ISSUES</b>	Access to Non-Traditional Workforce	not applicable	Facilitate discussion among stakeholders to develop targeted prerequisite and bridging programs that meet the cultural needs of the Aboriginal Peoples and the occupational needs of the region so that Aboriginal candidates qualify for training and employment opportunities.  Work with government, industry and stakeholder associations to integrate and provide access to information and contacts with respect to recognition of foreign education and/or experience in Canadian oil- and gas-related professional and trade associations.
	Skills Shortages	not applicable	Explore potential partnerships to share labour resources with industries that operate during the WCSB off-season and experience the same challenge of attracting and retaining workers.

		<b>HUMAN RESOURCES TALENT MANAGEMENT MODEL PRIORITY</b>	
		<b>Information, Strategy and Planning</b>	<b>Labour Market Entry</b>
<b>KEY ISSUES</b>	Labour Market Information Gaps	<p>Collect and analyze data on an ongoing basis on labour demands mapped to NOC codes or industry-identified categories so that gaps in supply are identified and annual action plans developed to address the gaps.</p> <p>Establish a forum of educators and industry to consider the potential for developing a national strategy on the delivery of oil and gas programs so that appropriate technical and/or academic programs are identified and strengthened or developed to address workforce demands of the industry.</p> <p>Develop an understanding of the nature and composition of the contractor workforce to better prepare for issues that may arise with skill shortages.</p>	not applicable
	Creative Human Resources Practices	Establish a central source to collect and communicate best practice information, thus facilitating industry and stakeholder access of this information.	Work with industry to ensure openings for on-site work experience and internships. Create a clearinghouse for educational institutions and employers to list workplace experience opportunities for students.

		<b>HUMAN RESOURCES TALENT MANAGEMENT MODEL PRIORITY</b>	
		<b>Attraction &amp; Selection</b>	<b>Retention</b>
<b>KEY ISSUES</b>	Promoting Careers in the Industry	Within each region, develop an information strategy to communicate with potential entrants, their parents and others who play a role in influencing career choices.	not applicable
	Access to Non-Traditional Workforce	<p>Work with industry to attract under-represented groups (e.g. women, Aboriginal Peoples, immigrants) to augment the traditional labour pool and to provide access to employment to these groups.</p> <p>Work with government, industry and immigrant associations to identify barriers and support solutions for new immigrants that attract and retain them for work in locations outside of the existing support infrastructure. <i>This is also a retention priority.</i></p>	<p>Work with industry associations and stakeholder groups to establish industry standards and resources (such as harassment policies) that foster a respectful work environment to attract and retain a non-traditional workforce.</p> <p>Evaluate current approaches to retention of Aboriginal workers to improve retention and career progression in preparation for increased participation in the workforce.</p>

		<b>HUMAN RESOURCES TALENT MANAGEMENT MODEL PRIORITY</b>	
		<b>Attraction &amp; Selection</b>	<b>Retention</b>
	Skills Shortages	Develop prior learning assessment tools to assess the skills of the semi-skilled workforce to improve attraction and retention and to streamline the selection process. <i>This is also a training &amp; development priority.</i>	not applicable
	Shifting Skill Requirements	Establish baseline or entry requirements for workers so there is greater awareness of the requirements of the industry (e.g. essential employability skills; mandatory certificates or training; other aptitudes.)	not applicable
	Mobility of Workforce	Employ strategies to attract, develop and sustain an appropriate workforce in remote areas to ensure an adequate supply of continuous labour. This could include pre-assessment tools and screening practices that involve educating candidates and their families about the realities of the work and social environment. <i>This is also a retention priority.</i>	Trades that are part of the upstream petroleum sector should be included in the Red Seal Program and trades workers encouraged to get their inter-provincial or inter-territorial tickets, so that labour mobility and the ability to meet regional demand are enhanced.
	Creative Human Resources Practices	not applicable	Work with stakeholders to assess and share best practices information and develop workplace integration programs for attraction and retention of non-traditional workforce into the industry.  Find ways to keep at least a core northern workforce employed year-round to keep northerners engaged in the industry.



		<b>HUMAN RESOURCES TALENT MANAGEMENT MODEL PRIORITY</b>
		<b>Training &amp; Development</b>
<b>K E Y  I S S U E S</b>	Promoting Careers in the Industry	Collaborate with the K-12 education system to explore opportunities for industry to provide practical application examples for curriculum so that students and educators can obtain a better understanding of how math and science are applied.
	Access to Non-Traditional Workforce	Develop a standard assessment tool and program model to be used to develop targeted programming that addresses attraction and retention barriers for non-traditional workforces. Components to consider include: education upgrading; technical skill development; language skills; employability/essential skills.
	Skills Shortages	Work with industry to establish occupational standards, apprenticeship, competency, and certification and training programs for occupations where supply gaps exist or will exist to improve workforce mobility, career path options and training consistency.  Conduct an analysis of the completion rates for oil-and gas-related apprenticeships (generally low) to identify the reasons, barriers and opportunities to increase overall journey certified workers.
	Shifting Skill Requirements	Collaborate with educational institutions to identify the key training needs of each sector and identify opportunities for local colleges, institutes and universities to provide training to employees.  Develop a common set of leadership skills, competencies and personal attributes so a pool of future leaders can be developed to ensure operational excellence within the industry.  Develop and implement flexible learning approaches including e-learning and distance delivery so that workers, especially in remote locations, have access to ongoing training and development opportunities.

### **Considerations**

The study also revealed a number of suggestions for change that lie more within the realm of industry, government, education providers and corporate human resources than the mandate of the Petroleum Council. These are offered as considerations for those stakeholders.

### **Best Practices**

Operational excellence is an approach industry has taken to improve the efficiency and effectiveness of its products and service delivery. Best practices in many disciplines have come from this focus on continuous improvement.

The report provides a sampling of human resources best practices from leading organizations of all types, and best and unique human resources practices from within the upstream petroleum industry itself.

### **Next Steps**

The Petroleum Human Resources Council of Canada was established to be a catalyst for change and a vehicle for collaborative action that assists the upstream petroleum industry in continuing to develop a qualified, motivated and agile workforce.

This study underscores the importance of collaborative efforts. In industries where the business environment is highly competitive, such as the oil and gas industry, collaboration can be difficult to achieve. The Petroleum Council, whose leadership structure incorporates all sectors of the industry in Canada, including workers, is well positioned to lead in building collaboration, broad stakeholder involvement and improved connectedness in the industry.

Now that this study and consultation with the Steering Committee has resulted in recommendations and considerations to address human resources issues within the industry as a whole and within the regions, the Petroleum Council will host a series of events that offer industry and other stakeholders the opportunity to participate in and learn more about the study findings, issues and recommendations. The events include:

- a series of regional meetings for industry and other stakeholders at Fort St. John, BC; Inuvik, NT; Fort McMurray, AB; Calgary, AB; London, ON; Halifax, NS; and St. John's, NL; and
- meetings with the Petroleum Council member organizations.

In hosting these events, the Council will work closely with industry, funding partners and other stakeholders to set priorities, and develop and implement action plans that address the human resources issues identified in the study on a priority basis.

The plans will be presented at two launch events:

- an information breakfast for executives from industry and other stakeholder groups; and
- an information lunch for interested stakeholders.

The action plans will be part of a broader national upstream industry human resources strategy that will address critical issues and build a platform for future industry growth and sustainable, attractive employment.

## **1. WHY A NATIONAL HUMAN RESOURCES STUDY WAS NEEDED**

The upstream petroleum industry is important to the national economy. Since 1990, economic activity by the industry has grown by 250 per cent. Today, the industry spends more than \$65 billion a year and accounts for six percent of Canada's gross domestic product. It is the country's largest private sector investor and contributes about 45 percent to the merchandise trade surplus. Expansion into new regions such as the East Coast has had a significant positive economic impact already, and the potential exists for similar growth in frontier regions such as the North.<sup>2</sup>

Globalization<sup>3</sup>, continentalization<sup>4</sup>, and the rapid growth of royalty trusts<sup>5</sup> contributed to restructuring of the upstream petroleum industry during the same period. This has had profound effects on human resources.

To assess those effects, the Petroleum Human Resources Council of Canada (the Petroleum Council) commissioned an independent, national study that considered the role of Canada's upstream industry within the global marketplace, analyzed current and future market challenges, and determined their impact on the domestic industry and its workforce. The report went on to identify upstream industry workforce demographics, skill and competency requirements, occupational supply and demand, key human resources challenges, and the impact of technology and the business environment on human resources issues. The detailed analysis can be found in Appendix C.

This report is intended to foster a common perspective on the industry's future and create a clear and compelling national plan to address its human resources issues.

### **The Role of the Petroleum Council within the Industry**

The Petroleum Council was established as one of nearly 30 sector councils<sup>6</sup> in October 2001 through the initiative of industry and the Sector Council Program of Human Resources Development Canada (HRDC). The Council's mandate is to support the upstream petroleum industry in its need to ensure the availability of skilled human resources to meet present and future requirements.

The study was funded by the Government of Canada's Sector Council Program, with contributions from many organizations and individuals.

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<sup>2</sup> The information in this paragraph is based on 2003 data from the Canadian Association of Petroleum Producers (CAPP).

<sup>3</sup> The technological reduction of distance and human-made barriers to the global exchange of goods and ideas, primarily since 1970, resulting in greater national interdependence.

<sup>4</sup> Continentalization, which generally refers to the increasing harmonization of policies across North America with respect to common concerns such as social issues, immigration and energy, has been driven by freer trade in gas and power and the efficient exploitation of mature assets. This trend has been largely played out as every large US independent has added Canadian gas to their lower 48 gas portfolio.

<sup>5</sup> Also known as an income trust, a royalty trust is an equity investment vehicle within the oil and gas sector that distributes most of its cash flow to unitholders (the trust equivalent of shareholders) at preferential tax rates.

<sup>6</sup> Permanent organizations comprising stakeholders of a particular industry, including individuals, company owners, corporate leaders, employees, government, educators, unions and industry associations. Sector councils analyze and address sectoral human resources issues.

## **Key Influences on the Upstream Industry**

Globalization leading to mergers and acquisitions, the maturation of areas such as the Western Canada Sedimentary Basin<sup>7</sup> (WCSB), technological advancement, frontier and new production development, changing demographics and regulatory requirements all challenge the upstream petroleum industry's ability to attract and retain a skilled workforce. While issues like these affect the industry nationally, their impact varies regionally.

### **Cyclical Nature**

One of the most important characteristics of the industry is its cyclical nature. This is based on global commodity prices for oil and North America prices for natural gas, seasonal development activity, and high frontier and new production development costs. It results in a boom-and-bust business environment that originates in the response of exploration and production companies to shifting business conditions. That response has a profound effect, in turn, on related businesses such as drilling and completions contractors, geophysical services, well service providers and pipeline transmission companies.

### **Restructuring**

Restructuring<sup>8</sup>, a common response to the cycles of the industry as well as to the maturity of the WCSB, has led to significant, recurring losses of skilled workers. Experienced mid-career employees often choose to consult independently to the industry or leave the industry altogether. In addition, new entrants to the job market frequently see the oil and gas business as one that does not offer long-term career stability and growth. This affects industry's ability to attract and retain top-flight people.

### **Regulation**

National, provincial and territorial governments regulate the industry. The nature of regulation varies widely across the country. Regulatory processes influence business development and, therefore, employment opportunities. For example, the regulatory environment in the mature WCSB is generally seen as fair. In contrast, the East Coast regulatory environment is considered to be onerous and costly in terms of both investment and time. In an age of global capital mobility, regulatory disparities such as these can affect investment decisions. Streamlined regulatory processes are important to continuing investment.

### **Stakeholder Consultation**

An influence related to the regulatory process, but not always formalized within it, is the broad and inclusive consultation by industry with its diverse stakeholders. More than ever, industry is accountable to its stakeholders and is expected to incorporate their diverse views into project planning and delivery. It is through such stakeholder consultation that industry secures its official and unofficial license to operate in all regions. Consultation has emerged as a key driver of industry's sustainability.

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<sup>7</sup> Historically, the most productive oil and natural gas area of Canada; includes most of Alberta and Saskatchewan and parts of British Columbia, Manitoba, the Yukon Territory and the Northwest Territories. As recently as 1997, the WCSB accounted for 99 per cent of Canada's oil and gas production.

<sup>8</sup> Reorganizing a company (and, by implication, an industry) through the reallocation of corporate investment in ways that optimize net profits.

## Life Cycle Stage

The operational characteristics of the industry in any given region of the country are closely related to the region's position within the industry's life cycle. Regions near the beginning of the life cycle, such as the North and the East Coast offshore, are managed differently from mature regions. This can have a significant impact on human resources issues, suggesting that different regions may require different human resources strategies.

## Workplace Skills

Finally, educational institutions and industry have begun to work together on training programs and resources that focus on developing critical skills for the workplace. Environmental and safety concerns, technological advancements, and the need to process and manage large amounts of data demand a highly skilled and knowledgeable workforce. Because it takes time to acquire skills and knowledge, the relationship between educators and industry will be important in addressing future skill requirements and the promotion of lifelong learning systems.

## Definition of the Upstream Industry

Traditional definitions of the industry include three sectors: upstream (exploration and production), midstream (processing, storage, large-diameter and small-diameter pipeline transportation), and downstream (refining and marketing). The study defined the upstream sector as including activities related to exploration, development, production, service industries, large-diameter pipeline transmission, gas processing, and extracting and upgrading heavy oil<sup>9</sup> and bitumen<sup>10</sup>. Downstream is not included in this study, but has its own human resources issues.

The study's temporal scope is limited to 10 years and does not include the construction phase of new projects.

The upstream petroleum industry consists of the following primary sectors:

### Exploration and Production (E&P)

Exploration and production core business activities focus on finding, developing and producing oil and/or gas reserves<sup>11</sup>. E&P companies vary widely in size and focus and tend to utilize consultants and the service industry to conduct its business.

### Service Industries

- Geophysical Services
  - Geophysical companies specialize in the collection, interpretation and management of seismic<sup>12</sup> data. Through this work, they determine the location of

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<sup>9</sup> Crude oil that does not flow easily and requires special refining.

<sup>10</sup> Petroleum in semi-solid or solid form, as found in the oil sands.

<sup>11</sup> Volumes of hydrocarbons considered economically recoverable using existing technology.

<sup>12</sup> A geophysical technique used to map subsurface geology by means of artificially produced vibrations.

potential oil and gas reservoirs<sup>13</sup>. Their clients are the exploration and production companies.

- Drilling and Completions
  - The drilling and completions segment of the upstream petroleum industry is one of the largest employers in the upstream industry. Its primary activity is the drilling of exploration and production wells. Most drilling companies concentrate on land-based drilling, while others do both land and offshore drilling. Some drillers have expanded to include additional drilling-related services. The primary clients of the drilling companies are the exploration and production companies.
- Services
  - Service companies, another large segment of the industry, include businesses as varied as well testing and wireline, pumping, road and lease construction, marine services and pipeline inspection. They provide services and products to the upstream petroleum industry during all phases of oil and gas activity. Their clients are the exploration and production companies and their business cycles are highly dependent on the activities of their clients.

#### Pipeline Transmission

- The core business of pipeline companies is the transport of crude oil and natural gas. In relation to the definition of the upstream petroleum industry, large diameter transmission pipelines<sup>14</sup> that move product to processing facilities and on to distribution lines are included in this study. The distribution lines<sup>15</sup> that move product to market are not. The major clients of the pipeline transmission business are the exploration and production companies.

#### Natural Gas Processing

- Natural gas processors operate facilities that clean gas so it can be sold commercially. In most cases, liquid hydrocarbons such as propane, butane and condensates<sup>16</sup> are removed.

#### Heavy Oil and Bitumen Extraction and Upgrading<sup>17</sup>

- The Oil Sands extraction processes include mining and in-situ recovery. Upgraders, which are owned by exploration and production companies, are facilities that upgrade heavy oil and bitumen into a lighter crude oil.

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<sup>13</sup> The underground source of hydrocarbons; typically rock containing hydrocarbons in tight pores.

<sup>14</sup> Large-diameter transmission lines are typically operated by companies that specialize in pipelines but do not own the products they transport. Transmission pipelines deliver unprocessed and refined products to small diameter distribution pipelines, industrial users, refineries and to connecting pipelines.

<sup>15</sup> Small-diameter gathering pipelines and flowlines that move crude oil and natural gas from wells to facilities for processing.

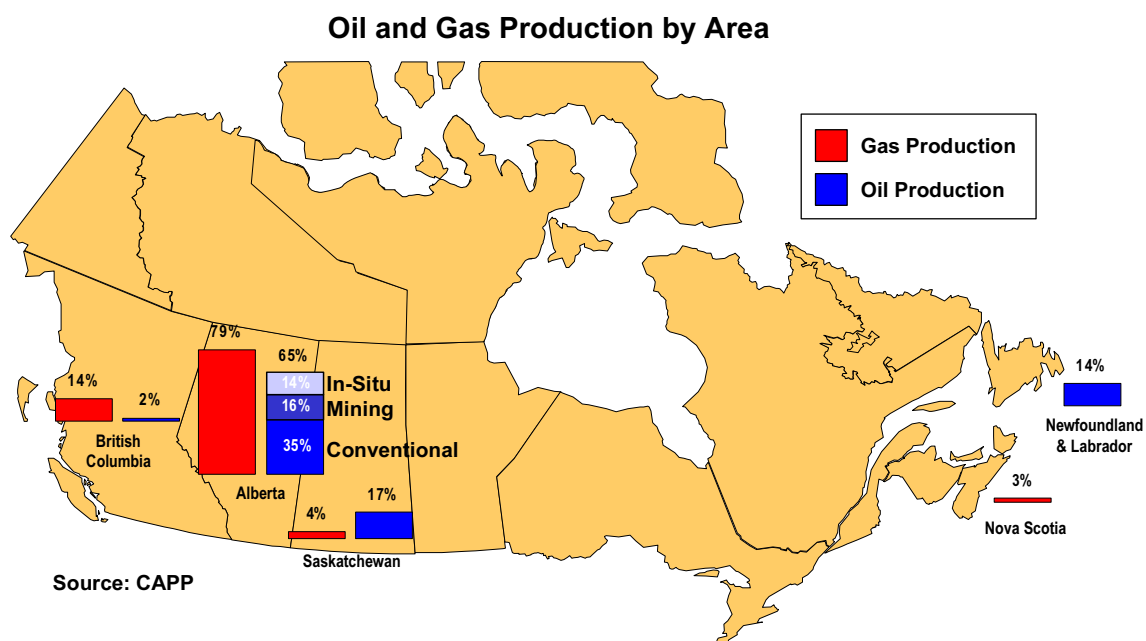
<sup>16</sup> Liquid hydrocarbons condensed from oil and natural gas wells.

<sup>17</sup> Oil Sands are vast deposits of tar-like bitumen mixed with sand found in northeastern Alberta and northwestern Saskatchewan. The bitumen is difficult and costly to recover and transport to market. In-situ recovery refers to various extraction methods for deeply buried bitumen deposits, including steam injection, solvent injection and firefloods.

## Geographical Scope of the Study

The study defined four main upstream oil and gas regions in Canada:

- Western Canada Sedimentary Basin (WCSB)
  - Alberta, northwestern Saskatchewan, northeastern British Columbia and parts of Manitoba, the Northwest Territories and the Yukon Territory;
- Oil Sands
  - primarily situated in northeastern Alberta and northwestern Saskatchewan;
- North
  - the Mackenzie Delta, Beaufort Sea offshore, and onshore areas in northern portions of the Northwest Territories; and
- East Coast
  - the offshore areas under the jurisdiction of Nova Scotia and Newfoundland and Labrador.



PROVINCE/REGION	% OF TOTAL CANADIAN GAS PRODUCTION	% OF TOTAL CANADIAN OIL PRODUCTION
Alberta	79	65
British Columbia	14	2
Saskatchewan	4	17
Nova Scotia	3	0
Newfoundland and Labrador	0	14
Manitoba	0.00	0.39
New Brunswick	0.00	0.00
Ontario	0.35	0.15
Quebec	n/a	n/a
The North	0.01	0.89
Source: CAPP 2001		

The industry also operates in Central Canada, where all sectors are represented to some degree.

Quebec does not have current production, but it does have mainline oil and natural gas pipelines. There is also some exploration interest. As most of this exploration is in the eastern portion of the province and linked geologically to exploration efforts on the East Coast, this report's analysis of the East Coast is also relevant to Quebec.

Ontario, which has produced petroleum continuously since 1858, now accounts for less than one per cent of the national total but provides more than half of Canada's natural gas storage capacity. The skills needed to find and exploit natural gas storage structures are virtually identical to those of the conventional petroleum exploration and extraction industries. Like Quebec, Ontario also has mainline oil and natural gas pipelines. While the Ontario industry is further along the life cycle curve than the WCSB, almost all of the human resources issues related to the declining, mature WCSB basin are directly relevant to Ontario. Therefore, this report's analysis and discussion of the WCSB can be applied directly to Ontario.

### Total Employment in the Industry

The number of exploration and production firms in the upstream industry is approximately 700 to 1,000, including explorers, majors, intermediates, juniors and small operations. Statistics Canada reports that 475 of these firms account for 95 per cent of domestic production.

The Statistics Canada 2001 Census estimates direct employment in the upstream petroleum industry at 120,040 jobs. The Canadian Association of Petroleum Producers (CAPP) estimates the total (direct and indirect) employment impact from the industry in Canada to be more than 500,000 jobs.

The very large exploration and production companies typically employ between 500 and 3,000 people, while the large oil and gas pipeline companies employ between 1,000 and 2,400 people. The levels of employment, particularly in the drilling/service sectors, vary with the level of field activity. However, as the chart below indicates, these sectors make up the majority of the employment in the upstream industry.

EMPLOYMENT IN THE UPSTREAM PETROLEUM INDUSTRY					
Region	Oil & Gas Extraction	Activities Supporting Extraction	Crude Oil Pipeline	Natural Gas Pipeline	Total
<b>Canada</b>	<b>49,800</b>	<b>65,165</b>	<b>2,415</b>	<b>2,660</b>	<b>120,040</b>
WCSB	39,575	54,080	1,725	2,115	97,495
Oil Sands	6,620	905	n/a	n/a	7,525
North	150	440	20	n/a	610
East Coast	1,550	2,295	40	25	3,910
Central Canada	1,245	5,960*	550	400	8,155
Other:	660	1,485	80	120	2,345
*For Central Canada, this number also includes mining occupations. Due to the nature of the occupational codes used by Statistics Canada, this employment figure could not be further differentiated to reflect only upstream petroleum industry.					
Source: Statistics Canada 2001 Census					



Organized labour, mainly the Communications, Energy and Paperworkers Union of Canada (CEP), plays a role in areas such as the Oil Sands, British Columbia and Alberta gas plant operations, Norman Wells in the NWT, and East Coast projects such as Hibernia and Terra Nova. There are approximately 3,200 unionized employees employed directly in the upstream sector.

### **How This Report Is Organized**

The report has been organized to suit the needs of a diverse group of readers. Its readers may be categorized as (1) those who wish to grasp the study's general findings while focusing on the human resources recommendations and (2) those who wish in-depth understanding of the study methodology and its conclusions.

The first type of reader will find the next two sections most useful. They provide a summary of the analytical models underpinning the study methodology, industry-wide and regional economic scenarios and their human resources implications, and proposed means of optimizing the industry's response to the human resources challenges of the next decade.

Readers in the second category may wish to supplement that high level discussion with the detailed analytical information provided in the Appendices. The Appendices are, in the main, synopses of the five detailed research modules that were prepared for the Petroleum Council.

## **2. THE WORKERS INDUSTRY NEEDS, WHEN IT NEEDS THEM**

This section of the report discusses the study's analytical models, relates them to probable regional economic scenarios and occupational supply and demand, and considers the implications for skills and competencies that industry will need. Specifically, it discusses:

- Four themes distilled from the research as a means of capturing and expressing the challenges, strategies and anticipated outcomes of a revamped approach to human resources within the upstream industry during the next 10 years;
- The conceptual framework that underlies the analysis. The framework is based in three explanatory models:
  - industry life cycle model;
  - upstream operational excellence model; and
  - human resources talent management model;
- Industry-wide observations on human resource challenges, supply and demand, and shifting skill and competency requirements; and
- Regional overviews on occupational supply and demand, and shifting skill and competency requirements.

### **Four Themes for the Future**

#### **Theme 1: Collaboration**

**There is a pronounced need for co-ordination and collaboration among industry associations, all levels of government, educational institutions, private training service providers, unions, and industry.**

Co-operation within the industry, spearheaded by industry organizations, is pivotal to managing the supply and demand of labour. Collaboration among industry, government and educational institutions can offer educators strategic direction that ultimately supplies the industry with qualified staff. Such partnerships can also attract well-qualified Canadians who are not currently part of the industry. In fact, collaboration is an exemplary or best practice.

Labour supply and demand is affected by the need to redirect trained workers to frontier and new production regions. This, too, depends on collaboration. There is a need to strengthen partnerships with Aboriginal and other local communities, enabling not only the development of new frontiers but also mutual gain from development of Canada's natural resources.

Co-operation among provincial and territorial jurisdictions is vital to the mobility of qualified trade journeymen, who constitute a significant segment of the oil and gas workforce. Although the issues associated with new construction are outside the scope of this study, it is clear the magnitude of the projects will create pressures on the supply of these workers. To meet that demand, inter-provincial and inter-territorial mobility of qualified trades is a must.

Where barriers exist to working in the industry, collaboration between industry and stakeholders is needed to remove those barriers. The resolution of issues such as affordable housing, adequate medical and education infrastructure and integration into Canadian work culture demand solutions that can come only from earnest dialogue and collaboration among all stakeholders.

## Theme 2: Excellence

**Company leaders and human resources professionals must adopt best practices that allow companies to attract talented individuals, retain them at challenging remote locations, and facilitate their movement from one region to another.**

Strategies for attracting and retaining workers must include more than competitive compensation. They must also address benefits, work environment, and training and development. During the next decade, human resources practitioners will have to accommodate more dual career families, keep older workers engaged in the workforce longer, and utilize more contractors, younger workers, and non-traditional sources of labour. Seasonal short-term employment cycles must be addressed.

The emphasis that industry has traditionally placed on compensation and benefit packages puts it at risk should other industries meet or exceed that standard. In fact, such competition is already evident.

Promotion of the industry must be undertaken by individual companies and the upstream petroleum human resources community, as well as by industry associations and government. Companies must develop mentorship programs, apprenticeship opportunities, co-op placements and high school programs that simultaneously elevate the image of the industry and capture the interest of students.

## Theme 3: Sustainability

**To grow and prosper, industry must have access to vital resources when it needs them. Those resources take many forms, including natural resources, innovative technology, investment capital, and human resources. The sustainability of the industry therefore depends, in part, on the identification and resolution of human resources challenges.**

To be sustainable, industry must be able to attract and retain top talent. The key to doing this is creating and maintaining a positive image of the industry. The ability of industry to attract high achievers depends on the degree to which individuals believe a career in oil and gas provides long-term rewards. Years of industry restructuring have created the opposite perception – that the industry is unstable – and this perception must be changed.

Industry can alter that perception to some degree by continuing to adopt practices such as collaborative partnerships, environmental stewardship, and social responsibility.

Sustainability also implies that industry organizations co-operate to gather labour market information to better define industry human resources more consistently. For example, industry's ability to perform critical human resources analysis quickly is severely hampered by the quality of existing human resources data sources, especially in the WCSB. The East Coast, Oil Sands and North regions have addressed this issue well and created a relevant means of predicting demand based on scenarios; however, most current jobs are in the conventional industry<sup>18</sup> of the WCSB and it does not have effective, accessible and repeatable sources of employment statistics.

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<sup>18</sup> Explores for and develops conventional oil and gas reserves; that is, reserves not designated heavy oil or bitumen (Oil Sands) deposits.

With the exception of the Oil Sands region, the impact of retirements among the baby boom generation<sup>19</sup> lies beyond the 10-year timeframe of this study. Still, it is critical that company leaders recognize the current decade as a grace period rather than a reprieve from this serious threat to sustainability. Organizations have time to segment their workforce, analyze high demand occupational risks, and respond with succession and workforce planning that may alleviate the pressure of an aging population. These strategies will prepare and support workers for the rigors of offshore, northern or remote location work and provide the means to redeploy and capitalize on the existing workforce.

#### **Theme 4: Optimization**

**Industry optimization must be a proactive, long-term strategy. Optimization means maximizing profit, leveraging technology to improve efficiency and automate labour-intensive processes, and possessing the right people at the right time for the jobs at hand.**

Today's upstream industry focuses on continuous improvement or operational excellence approaches to meet ongoing operational challenges and maximize shareholder returns. Often, this focus results in layoffs, restructuring, and downsizing to improve short-term profitability.

Shareholder demand for improved returns will continue to drive cost reductions, especially in mature regions such as the WCSB. The volume of daily average well production for conventional oil and gas operations will continue to decline, resulting in a higher cost per unit of production over time. Reliability of production will remain important.

In the WCSB, the adoption of new technology to improve efficiency is accelerating. This means employees must be better educated, more proficient with computers, and more willing to accept broader roles and greater responsibilities.

To address these challenges, industry will likely embrace the principles of operational excellence more completely than it has to date. In fact, some companies will make operational excellence their core business strategy. Human resources strategies must reflect that trend.

#### **Three Guiding Analytical Models**

The maturity of the upstream petroleum industry affects human resources issues nationally and regionally. Because of this, the industry life cycle model has been used to highlight regional differences and to link the state of the industry to human resources issues.

Secondly, the operational excellence model is an operational and strategic management approach that has been adopted by a number of upstream industry leaders. It provides insight into the expansion of the industry into frontier and new production regions and into the key factors that influence industry operation in mature areas.

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<sup>19</sup> The large and well-educated generation born between 1946 and 1964. This generation was followed by a group with a remarkably low birth rate, which will lead to a potential labour and skills crisis as the baby boomers retire within a relatively short period.

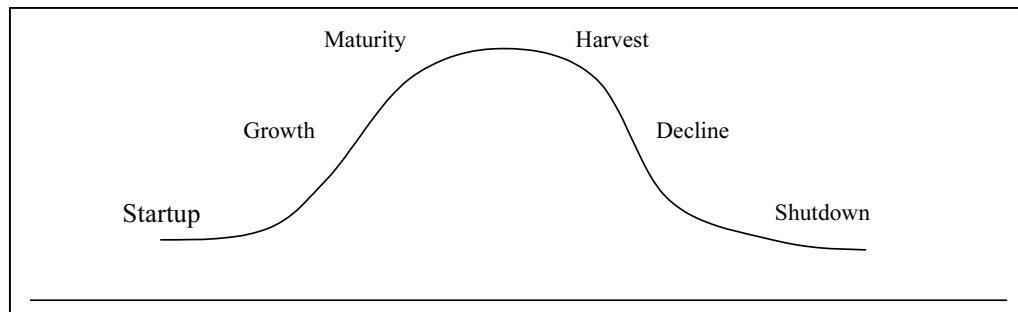
Thirdly, the human resources talent management model provides a structure for analyzing human resources issues. The model can also be used to demonstrate a systems perspective of human resources practices and strategies.

### Model 1: Industry Life Cycle

Each region of the upstream petroleum industry is unique due to the nature of the resource itself (e.g. heavy oil versus arctic gas) and its position on the life cycle continuum. Given this, a single set of human resources recommendations for the industry would not be effective. It is critical to understand where each region is within the life cycle and use that context to frame recommendations for change.

The key elements of the industry life cycle model are highlighted in the diagram and descriptions below:

**Upstream Industry Life Cycle Chart**



**Startup:** risk capital is invested in the exploration for new fields and drilling of test wells. This is followed by some early production success, research, development and testing of new technology, and by the addressing of land and regulatory issues.

**Growth:** reserves are proven, exploration and drilling programs are developed, new discoveries are made, infrastructure is developed, most regulatory and land issues are resolved, resource production increases, and industry focuses on hiring and training employees.

**Maturity:** reserves are stable with few new discoveries, exploration and drilling programs focus on reserve replacement, continuous improvement focuses on cost optimization and production enhancement, regulatory and land issues are resolved, hiring stabilizes and many staff become experienced.

**Harvest:** reserves and average daily production per well decline, more wells are drilled to maintain annual production, continuous improvement focuses heavily on cost reduction, staff reduction becomes more common through increased use of technological improvements, research and development is outsourced to service companies, and investment is made in system integrity with a focus on exploitation management.

**Decline:** wells and fields are shut in<sup>20</sup> or sold, more wells are suspended or abandoned, there is no significant exploration and overall drilling decreases, daily well production is significantly reduced and nearing marginal status, there is little or no investment in equipment, and large layoffs are experienced.

**Shutdown:** wells and fields are no longer economical, production areas are shut in, wells are abandoned<sup>21</sup>, equipment is redeployed or sold, fields are reclaimed, remaining jobs are lost or redeployed.

Each producing region in Canada is at a particular stage in the industry life cycle. The model provides a background to better understand the stages and subsequent business practices of each region and the industry as a whole. These are identified in the regional overviews later in this report.

### **Model 2: Upstream Operational Excellence**

Operational excellence is an operational and strategic management approach that focuses on providing limited, reliable and consistent products and services at the lowest total cost. As the entire upstream industry matures over the next decade, it will place greater emphasis on operational excellence principles. This will be most evident in the WCSB, but also in the Oil Sands as that region will be well into its growth phase. The North and the East Coast will likely be advanced in the startup phase, and potentially into the early growth phase. This is particularly true of the East Coast. There, the key drivers of operational excellence will be cost optimization and production enhancement.

Understanding operational excellence is important because:

- The upstream industry is in the business of finding, developing and producing oil and gas commodities. Some degree of commodity processing ensures they can be transported to midstream and downstream processing facilities while meeting consistent standards for quality. There is no product differentiation;
- Oil is valued at the world market price and natural gas is valued in the North American setting. For example, as there is no real differentiation among oil products produced in Alberta or East Coast offshore, prices are consistent across Canada;
- Companies generate revenue and profit based on a high-volume, low-margin environment where higher prices and lower operating costs improve shareholder returns; and
- Companies working in this environment have learned that standardization of processes and procedures that leverage technology improvements increase efficiency and predictability, eliminating waste and duplication so operations may run at the lowest total cost.

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<sup>20</sup> Taken out of production by shutting off flow at the wellhead with the expectation of resuming production in future.

<sup>21</sup> A well rendered incapable of further oil and gas flow whose site has been reclaimed in accordance with recognized environmental standards.

Companies focused on operational excellence typically pursue:

- Continuous improvement and re-engineering of business/work processes;
- Effective human resources management practices focused on clear employee accountabilities, efficient and consistent work processes, and consistent training and development for staff and leaders;
- The elimination of any process that does not add value to customers;
- Advantages through economies of scale and optimized capacity utilization;
- Improved efficiency and productivity at every level;
- The ability to provide customers with reliable, consistent and standardized products/services that offer value for money and security;
- Efficient and consistent standards, procedures and training for people; and
- Outsourcing of non-core work.

### **Linking Operational Excellence and Corporate Human Resources**

In an industry embracing operational excellence, human resources professionals need to emulate the same model. Waste, inefficiency, duplication of effort and rework are seen as costly by industry, while consistency, process efficiency, reliability and leveraging technology are seen as adding value. From a corporate human resources perspective, this implies:

- Highly efficient, streamlined and reliable processes;
- High quality and accurate data;
- Minimal bureaucracy; and
- Lowest total cost to ensure alignment with the business model.

Examples of operational excellence within human resources functions include:

#### **Attraction and Resourcing**

- Adoption of digital technology to encourage online job applications for external candidates and online skill/resume inventories of existing staff to identify required skills or candidates for succession;
- Partnering with key stakeholders such as government, industry associations, universities, technical institutions and high schools can enhance the sourcing of potential employees, particularly if there is an efficient, integrated database in place to match skills with opportunities.

#### **Performance Management**

- Leaders ensure that clear operating and safety policies and procedures are followed strictly to minimize risk and cost;
- Personal performance plans and development plans are established and monitored to ensure staff are meeting job requirements and preparing for future job opportunities;
- Teams are trained in the elements of continuous improvement to implement solutions that result in measurable cost reductions or production enhancements; and
- Job descriptions, career ladders, skill requirements and employee handbooks are presented clearly and made available electronically.

### **Retention**

- Expanding the existing compensation and benefits strategy to include other total compensation approaches and standardizing these to help address the attraction challenges, particularly in the frontier and new production regions;
- Challenging work and development of creative and cost-effective training and development solutions must be considered, including apprenticeship programs, outsourced programs at educational institutions or computer-based training for technical certification and advanced degrees; and
- With industry expecting better and broader trained workers, stewarding of an efficient knowledge management process will be a key strategy for human resources departments.

### **Transition**

- To address fast-paced transitions, including mergers and acquisitions, restructuring, downsizing, promotions and lateral transfers, efficient deployment of the right staff to the right position is critical;
- Integrated employee data systems can foster effective transitions by identifying existing skill sets and when and where they are required; succession plans and specific skills, competencies and positions that fit with core business processes are in place and standardized to ensure that consistent high quality outputs are achieved throughout the business;
- Standardized outplacement services ensure consistency and reduce cost through consistent, long-term service level agreements.

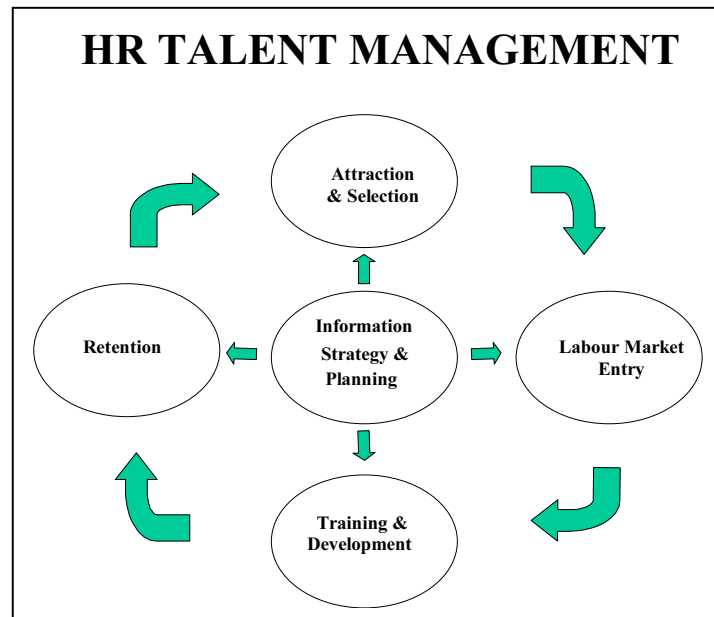
As the industry evolves and embraces operational excellence principles to reduce cost and improve productivity, corporate human resources systems must look to concepts like these in order to align better with the prevalent management philosophy.

### **Model 3: Human Resources Talent Management Model**

Companies also operate within a much larger system and the operational excellence framework will influence how the industry acts as a whole and interacts with other stakeholders. For this reason, this study proposes a model that offers a broader systems viewpoint of human resources management functions – the Human Resources Talent Management model. Complex human resources issues that are industry-wide will require the participation of human resources professionals in broader solutions involving diverse stakeholders. In turn, resolution of industry-wide issues will enhance the ability of a company to be operationally excellent.

The Human Resources Talent Management model helps define key upstream human resources issues and recommendations to address them within a broader, system-wide framework.





### **Information, Strategy and Planning**

- Central to the model are issues and practices relating to the need for a strong information base to guide strategy development and planning for human resources. This will require complex interactions between industry and other stakeholders to collaborate and partner on data collection, information sharing and workforce planning issues and opportunities.

### **Attraction and Selection**

- This element focuses on industry characteristics, practices and strategies that influence public perceptions of the industry as a place to work. Mechanisms for bringing potential employees into the industry include promoting career opportunities, industry offerings and a positive industry image.

### **Labour Market Entry**

- This element focuses on the issues and challenges of preparing the potential workforce to meet the skill requirements of the industry. This includes the transitional steps needed to prepare and support youth, non-traditional workers and mid-career entrants to enter the petroleum workforce.

### **Training and Development**

- This includes practices and strategies related to providing skill development solutions supporting industry requirements. Related activities could be developing occupational standards, competency models, apprenticeship and certification programs and influencing the development and enhancement of curriculum.

### **Retention**

- This element covers strategies and practices that impact how the work environment is perceived by those who are a part of it. These include compensation and benefits, work environment practices, alternate work arrangements and career development.

## Industry-wide Observations

### Assessing Key Human Resources Challenges

The industry will continue to restructure in response to competitive pressures and commodity price fluctuations. While the industry must respond to the external economic and business environment, industry leaders should consider the longer-term impact of those decisions in light of the challenge of attracting and retaining skilled workers.

A 1992 industry study<sup>22</sup> discussed human resources challenges the industry would likely face during the subsequent decade. As substantive, industry-wide solutions have not materialized during the intervening years, many of those challenges remain a concern.

Two of the key human resource factors analyzed here are **occupational supply and demand** and the **shifting skill and competencies** required by the industry. The following sections discuss these factors from an industry-wide perspective.

### Occupational Supply/Demand Analysis

Long-term labour supply/demand gaps can be assessed using labour demand forecasts and analysis of occupations that may lose workers through retirement, and post-secondary enrolment rates.

Scenarios, for both high and low cases, were developed for each region to forecast industry activity and its impact on labour demand over a 10-year period. The scenarios for each region are covered fully in Appendix C.

Labour supply analysis for occupations requiring post-secondary training has been done by reviewing enrolment and graduation information from Statistics Canada. By reviewing the trends in enrolment rates over the most recent years it can be determined if the supply of particular skill sets is growing, shrinking or staying about the same.

Both quantitative and qualitative data were necessary to provide an accurate supply picture for occupations within the industry that do not require post-secondary training. These include apprenticeships and a number of entry-level positions in the seismic, service and drilling sectors. Looking at the data on the supply of untrained or unskilled workers in isolation would lead to the conclusion that there is no shortage. This labour pool is significant and available to industry. However, relying solely on this statistic is misleading because most of the industry cannot utilize the “unskilled” worker to a great degree. In fact, the majority of the industry reports that the standard for entry-level skills has risen, and now includes literacy of technical language and essential employability skills and aptitudes across a broad range of competencies (i.e. mechanical aptitude, exposure to technology, and literacy). Therefore, most of the industry can only use that segment of the unskilled labour force with the requisite entry-level skills.

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<sup>22</sup> Human Resources in the Upstream Oil & Gas Industry, Human Resources Development Canada, September, 1992.

The geophysical service sector may be the exception, as many of their field crew positions are similar to those of general labourers and do not require prior skills or training. However, they still compete with a number of other industries for general labourers and the sector is challenged because their work currently is seasonal and does not have the same competitive compensation other sectors of the industry enjoy. This sector once met its requirements from the rural labour pool, but that labour pool has shrunk appreciably in recent years.

This study also analyzed potential attrition through retirements by reviewing age demographics data for the existing workforce in each region. It is not possible to predict actual attrition rates due to retirement as this depends on factors that are hard to measure. Looking at age demographics does assist, however, in identifying the potential risk associated with retirement eligibility.

The nature of the industry across the country makes regional supply/demand analysis mandatory. Three of the four regions included in this study have already conducted demand analyses. An overview of each of the regional analysis follows this industry-wide section. Details of each regional analysis appear in Appendix C. Connecting those regional analyses to the industry as a whole is important to understanding how demand in one region affects other regions.

### **Risks to Occupational Supply/Demand Balance**

Total direct employment in the entire upstream oil and gas industry among the four regions of this study is approximately 110,000 workers. Under the high case scenario, the net increase in employment across all four regions is approximately 7,000 by the end of the forecast period. Under the low case scenario, the net change in employment is a decrease of approximately 1,500 by the end of the 10-year forecast period.

However, the figures for employment for the industry as a whole do not reflect some significant changes in regional job distribution and other issues that will challenge industry's ability to balance supply and demand.

The supply analysis for professional and technical employees has been developed using enrolment trends for upstream training and education programs. The study assumes the current trend will continue and that graduates will be attracted to the oil and gas industry at the same rate as today. This does not take into account the possibility of activity in other industries that may attract graduates away from oil and gas. The challenge will be to develop a more positive image for the industry and to hire new grads into entry-level positions.

Approximately 10 per cent of the industry's workforce consists of individuals on contract or engaged through other consulting arrangements. Anecdotal information from industry indicates that many of the consultants are down-sized employees or early retirees with specialized skills, experience and involvement in a variety of industry work activities. Demographic data did not separate age information for this portion of the workforce. Given our understanding of the characteristics of this workforce and the lack of precise demographic information, the supply/demand impact on these individuals is uncertain. Since industry now depends on contractors/consultants to fill certain jobs, it would be useful to gather more information.

Much of the demand comes from remote areas, so mobility is vital to getting supply to regions with demand. In addition to the difficulty of promoting work outside urban centres, there are other barriers to mobility. Some barriers exist because qualifications are not recognized province to province to territory and others exist because workers have not accessed the programs for inter-provincial/inter-territorial mobility. The “first considerations” clauses of the Atlantic Accords can also be a barrier to securing required workers. This clause requires that qualified workers in either the home province of Newfoundland and Labrador or Nova Scotia are to be considered first for available positions. Mobility is difficult for two career families, especially when the move is to an area with a limited variety of employment. In addition, study participants indicate that employees with qualifications such as trades and some technologies that are transferable to other industries often prefer to change industries rather than change their home location.

The lack of standardized certification and training for semi-skilled positions found in the drilling, services and seismic sectors impedes the ability of workers to prove qualifications and competency and move from employer to employer or from region to region.

Many East Coast positions require specialization, yet the region does not have the critical mass to support hiring of new graduates who need experience. The short-term or project-based nature of the employment also makes it difficult to attract qualified candidates to the area.

The current shortage of journeymen trades found in all regions will only worsen as general industry construction accelerates and the impact of retirements is realized. Since the skills associated with most trades are transferable across industries, the petroleum industry will have to be diligent in attracting and retaining trades workers. This can only occur by hiring apprentices and contributing to the development of the qualified labour pool of trades workers.

The growth associated with the occupations in the Oil Sands will affect supply for the rest of the industry. That growth will create supply/demand pressure points for occupations such as power engineers, process engineers, heavy duty mechanics, heavy equipment operators and trades workers in general.

For Northern development and the Oil Sands in particular, attracting and integrating Aboriginal Peoples into the workforce will be important in addressing the supply issue. The sometimes difficult progression from education and training to long-term employment needs to be better understood and managed. To do this, greater appreciation of the differences in Aboriginal and non-Aboriginal cultures is needed.

Industries are taking advantage of the Foreign Worker program through Immigration Canada that allows companies to bring in workers for a limited period of time to fill positions that cannot be filled by Canadians. A significant number of mechanical engineers, electrical and electronic engineers, chemical engineers, industrial instrumentation technicians and mechanics, industrial electricians, millwrights, engine room crew, deck officers, drilling and service supervisors, and labourers have been brought into the country. This indicates difficulty in finding these skill sets across all industries including the upstream petroleum industry.<sup>23</sup>

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<sup>23</sup> Immigration Canada, Foreign Worker Program, 2002

For the WCSB, the more serious age-related attrition issues begin immediately outside the 10-year time horizon of this study when more than 40 per cent of the workforce enters retirement eligibility. Since the vast majority of the industry's workforce is employed in the WCSB, this has significant implications for the industry as a whole. The industry has the opportunity to mitigate the risk associated with these demographics by doing workforce planning and increasing the number of new entrants where a corresponding number of departures are expected to occur.

Finally, there is a much broader awareness of human resource issues, the impact of the aging workforce and competition for skilled workers across all industries. Attesting to this is the formation of 26 sector councils, including the Petroleum Council that was formed to address human resource challenges across a number of industries. This heightened awareness is resulting in broader industry human resource strategies and possibly an increasingly competitive environment across industries for skilled workers.

### Shifting Skills and Competencies

The identification of shifting skills and competencies on a regional basis is covered later in this report. In many cases, the drivers behind these shifts are related to the region's life cycle, technological development and regulatory focus. A number of trends relative to the industry as a whole were also identified.

Industry-wide trends that are emerging include:

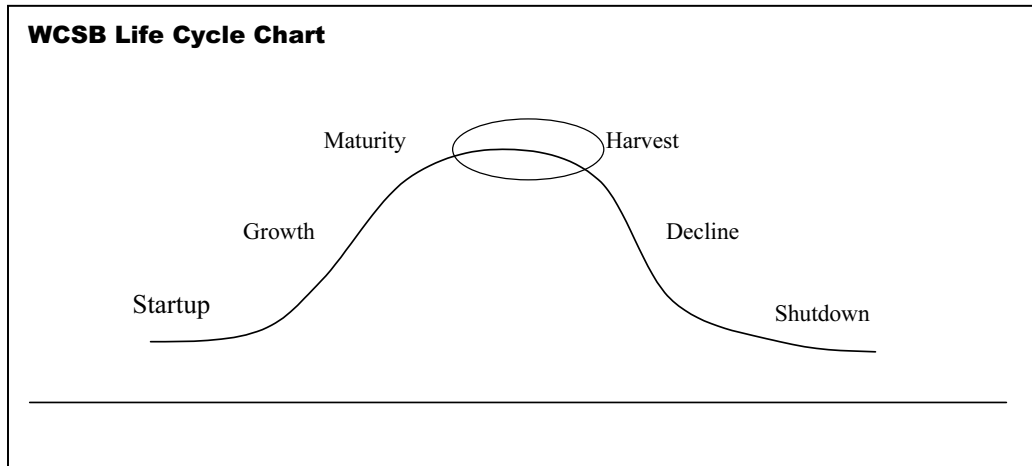
- **E-learning, computer-based training and self-study** are the preferred method of delivery for training. Technical training curriculum and soft skill training programs are now being delivered online. As more employees gain access to technology, the use of e-learning environments becomes more prevalent. On East Coast offshore facilities, where employees are on the facility "24/7", the use of this technology permits employees to use their time effectively for skills upgrading, soft skills training and formal education programs. Overcoming the technology barriers requires employers to invest in the technical infrastructure to support Internet and online programs;
- **Technology skills** – the importance of technology skills essentially spans all positions in the upstream oil and gas industry across all sectors. Many companies reported that technology was a key focus for their competitive strategy. Overall, increased use of technology is expected to change the nature of many jobs within the industry. In most cases, the job itself will not change. Rather, the way in which the job is undertaken may evolve. For example, the gathering of production data at well sites will likely become more automated. The skills of the field operators will therefore evolve to include the ability to use and diagnose the remote monitoring equipment. The basic skill of interpreting seismic data will not change but the tools available to support this work will continue to evolve and become more sophisticated and powerful. Awareness of how technology is shaping the nature of their jobs will be essential for a majority of employees in the upstream oil and gas industry;
- **Interpersonal/problem solving and leadership skills** – these skill sets, which include leadership, problem solving, communications, team orientation and decision-making are considered significant to the industry as the workforce ages and the need for transitioning responsibility to younger workers becomes important. Demographic pressures amplify the need for mentoring skills within the older workforce, while the younger workforce learns management skills. Communication

skills are essential in the highly technical oil and gas industry and critical to project management – a skill that is in increasing demand as the industry focuses on non-conventional activities. In addition, as the industry’s workforce becomes more diversified and operations expand into more remote and diverse communities an understanding of diversity will be very important. Almost all companies with formal training and development programs (i.e., the larger companies) indicated that interpersonal/problem solving skills were an integral and increasingly important element of their overall employee development objectives;

- **Cross-functional skills** – these skills enable employees to perform in more than one functional area of the organization. They may include more than one professional skill area (i.e., geology and business acumen) or dual trades (i.e., millwright and welder). The value of cross-functional skills in the labour force is flexibility and versatility for the employer and mobility and employability for the employee. While many organizations report that cross-functional skills are considered to be desirable, the vast majority of employees are focused on a single functional area. Many of the organizations surveyed reported a desire to provide employees with exposure to different functional areas over their career but this was not seen as formal cross training;
- Since the nature of the work in the oil and gas industry often calls for **multi-disciplinary skills**, the use of multi-disciplinary teams is prevalent in the industry. For example, exploration teams often bring together geologists, reservoir engineers, landmen and supporting technicians to efficiently exploit the resources in a specific geographic area. While the desire to have individuals with multiple skills was expressed, the majority of study participants indicated that use of multi-disciplinary teams was likely to continue for the foreseeable future, especially as individual roles become more complex;
- **Business skills** – business literacy (or acumen) has become increasingly critical to operating in a more challenging economic environment for the industry. Business literacy is the understanding of how economic forces are affecting the operations of the industry as well as the financial skills to establish or understand sophisticated budgets and other financial instruments that facilitate the management of the business. Enhanced development of business literacy, supported by decision-making skills, has been identified by participants as a future key competency that will be a priority area for training and development programs;
- The advent of **demonstrating competencies** to meet existing regulatory requirements will increase the focus of employers and employees towards a competency based framework; and
- Research completed by Human Resources Development Canada and echoed in the research for this study, identified **nine “essential skills”** required by all workers to enhance their ability to competently perform their work duties. They are:
  - reading text;
  - document use;
  - writing;
  - numeracy;
  - oral communications;
  - thinking skills;
  - working with others;
  - computer use; and
  - continuous learning.

## Regional Overviews

### Western Canada Sedimentary Basin – Late Maturity/Early Harvest Phase



#### Overview

The Western Canada Sedimentary Basin is in the late maturity/early harvest phase of its life cycle. Production is projected to decline significantly over the next decade. Technology will be developed and adopted and operational principles will focus on optimizing costs and delivering shareholder value. Shifts in skill and competency requirements will occur as a result.

Basic expectations:

- Gas production may plateau for several more years; however, it is showing early signs of decline. Improvements in technology will be seen particularly in “new gas” (i.e., coal bed methane<sup>24</sup>, tight gas<sup>25</sup> and deep gas<sup>26</sup>);
- Increased numbers of wells drilled with less average daily production per well;
- Regulatory policies are well developed;
- The management approach will focus on operational excellence, cost reduction, and production optimization;
- The royalty trust “efficient harvest” model will continue;
- Expect to see ongoing, cost-effective, incremental technology improvement; and
- Significant technological research and development will be undertaken by service companies leveraging global technology advances.

As the conventional upstream petroleum industry continues to mature from the maturity/harvest phase of its life cycle, it will place more emphasis on cost reduction and production enhancement as a means of delivering acceptable shareholder returns. Advancements in technology from within service companies will improve efficiency. While breakthrough technology is not expected in drilling or production, exploration technology will continue to advance.

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<sup>24</sup> Natural gas contained in coal seams whose principal constituent is methane.

<sup>25</sup> Low-grade gas deposits held in impermeable formations.

<sup>26</sup> Gas in “deep” reservoirs, typically more than 15,000 feet below the surface.

Although more wells are being drilled, reserve replacement and the average daily production of wells continue to decline. The conventional industry is focusing on new gas reserves such as tight gas, coal bed methane and deep gas to add to current reserves. New technology must be developed to extract and process these resources cost effectively. Enhanced recovery will be a key initiative in the WCSB during the next 10 years and, if successful, may address some of the current reserves and production concerns.

Significant technological research and development will be undertaken by service companies leveraging global technology advances.

Outsourcing of non-core work will continue, as shown by research and development migrating to the service companies and the contracting out of maintenance work. As the industry leverages information technology (IT), the scope of jobs such as geoscientists, engineers and field operators will broaden.

As the conventional industry moves into the harvest phase of its life cycle, environmental concerns from aging infrastructure are emerging. Demand for environmental, safety and corrosion specialists, for example, will likely increase.

### **Occupational Supply/Demand Analysis**

To forecast changes in labour demand within the WCSB, a relationship between the level of drilling activity and overall in-scope employment levels in the industry was established. The analysis indicates overall employment levels will decline. The decline in employment levels between the low and high case scenarios is approximately 76,000 and 79,500 by 2012 respectively, compared to 97,495 today.

A key driver of the labour supply/demand gap is the rate of attrition through retirements - an issue affecting all industries. Approximately 28 per cent of workers in the WCSB are now age 45 or older. Given retirement rates and the decrease in projected labour demand, it is expected there will be a balance between labour supply and demand except in some specific occupations. The industry can balance labour supply and demand better by implementing programs that keep mature workers in place longer while ensuring that sufficient new hires are made to sustain occupational families. Similarly, since the demographic analysis suggests retirement of skilled workers will not be an issue in this decade, the industry has time to prepare for this demographic shift.

Despite a projected decrease in overall labour demand during the next 10 years, some occupations are likely to be in short supply. Supply/demand gaps for professional and technical occupations within the WCSB have and will continue to be limited to “hot skills”, which are defined as particular occupations where demand temporarily exceeds supply. This phenomenon is attributed to the cyclical nature of the industry where industry has reacted by restructuring with significant downsizing. This has resulted in the loss of a number of experienced, mid-career employees and has negatively affected the public perception of the stability and growth of the industry. The perceived instability has resulted in periods when students did not choose oil and gas careers and this, coupled with a decrease in hiring of entry-level positions, has created demographic gaps in some occupations.



As for potential “hot skills” in the next decade, many critical in-scope occupations have more than 40 per cent of the labour force at age 45 and older. These include engineering, technology and operations-related positions. Demand for some key occupations will also increase as a result of technology or changes to business processes that reflect the WCSB’s life cycle stage and the need to minimize costs. These also include engineers (corrosion, electrical and chemical, among others), technicians (electrical and instrumentation, in particular) and environmental positions.

Hot skill shortages also can have a significant impact on the small exploration companies as they employ very few people, generally more for experienced employees. These companies are run by people who enjoy the challenge of starting and building new companies for the opportunity to sell and start again. They typically hire individuals who are interested in the associated risks, rewards and challenges, and less interested in promotion through the ranks.

Drilling, seismic and service sectors of the industry all have difficulty attracting and retaining skilled workers. This creates concern within the industry about sustainability and safety. Traditionally, these industry sectors have drawn workers from rural areas, but this labour pool has shrunk. The industry’s seasonality is also seen as an impediment to attracting and retaining a skilled workforce. Another issue is the myth that these sectors can readily draw from the “unskilled labour pool”.

Even with predicted lower drilling levels, the current difficulties in finding entry-level workers are expected to continue. As well, age demographics indicate a significant number of those in supervisory positions in the drilling and services sector will become eligible for retirement during the next decade. Retaining workers to fill those positions will be critical for these sectors. Industry associations have begun to address systemic barriers to the attraction and retention of workers. These solutions include optimizing the drilling cycle to address the seasonality of work, and developing and implementing competency-based programs that provide workers with a career path and the skills to mitigate safety concerns.

Demand is driven by an increased rate of abandonment of wells that leads to higher service company employment levels; a decrease in seismic activity; aging pipelines and processing equipment that require increased maintenance, and more sophisticated technologies that maximize production. Attrition rates due to retirement have also been taken into consideration.

<b>OCCUPATIONS EXPECTED TO HAVE SIGNIFICANT CHANGES IN DEMAND IN THE NEXT DECADE IN THE WCSB*</b>	
<b>Occupations Expected to Increase:</b>	<b>Occupations Expected to Decrease:</b>
Electrical Engineer	Seismic Permitting Coordinator (Seismic Acquisition)
Instrumentation Engineer	
Instrumentation Technician	
Industrial Electricians	
Industrial Millwrights	
Stationary Engineers	
Process Operators	
Supervisors, Drilling & Service Sectors	
MWD (Measurement While Drilling) Coordinator	
MWD (Measurement While Drilling) Specialist	
Quality Assurance Analyst	
<p>*The WCSB high demand occupations cannot be reported in absolute numbers due to the data collection methodology utilized. Data from Statistics Canada and categorized according to the NOC (National Occupational Classification) codes have been utilized for the WCSB due to the low rate of return of the industry headcount survey.</p> <p>Each NOC code includes several occupations. For example: <i>NOC 2145 Petroleum Engineers includes the occupations of Drilling, Petroleum, Reservoir, Well Services (Testing, Field, Wireline) and Field Engineer.</i> The discrete number of each of these engineering occupations is not available within this aggregate data.</p> <p>In the absence of modelling results more disaggregated than the NOC code level, expert analysis of each specific occupation within the NOC codes has been undertaken. Industry experts were consulted and asked to evaluate the specific occupation in light of maturity and industry activity; changing technology and business processes. Occupations where growth is expected to occur, notwithstanding the overall downward trend predicted in employment levels, are reported. Those occupations expected to experience a decrease in demand are also identified.</p>	

### Shifting Skill and Competency Requirements

The WCSB is in the late maturity/early harvest phase of its life cycle. Production is projected to decline significantly over the next decade. Technology will be developed and adopted and operational excellence principles will be implemented to optimize cost and deliver shareholder returns. Shifts in skill and competency requirements will occur as a result.

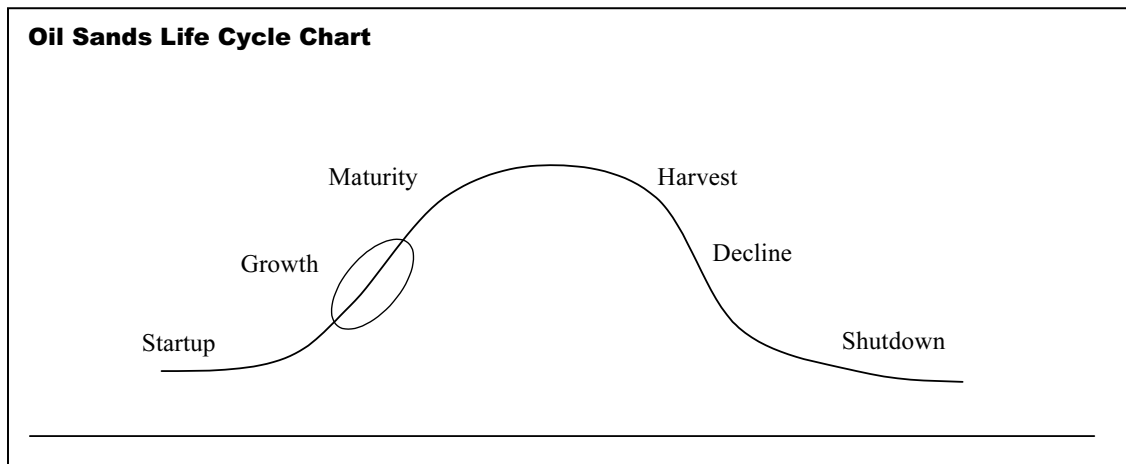
The analysis of technology trends in the industry indicates greater focus on seismic processing, inversion, depth migrations, and importing techniques from other areas. This will result in skill demands for seismic interpreters (currently a global shortage, most interpreters are geologists), structural geologists experienced in compressional regimes (WCSB Foothills), petrophysicists, and skilled IT professionals. It was also reported that model-driven programs would support an evolution from integrated teams to individuals with multiple skills. These skills would cross a wide range of disciplines including economics, geoscience, and petrophysics. With continued improvement of work flow processes in the use of workstation technology, and improved data quality, the result will be integration of knowledge across asset teams or individuals. Finally, interactive workflow and sharing of skills between E&P companies and service companies will be possible to optimize costs, optimize inventories, and reduce cycle time.

Technological improvements are playing a significant role in drilling with a related impact on people requirements. With the advancement of rig automation, more roughnecks and operators will operate in cabs above the floor using joystick controls and computer consoles instead of traditional levers. More and higher level skills will be needed to keep pace with the technology improvements and automation, with correspondingly less emphasis on physical skills. The baseline skill set for entry into the industry includes essential employability skills: a level of literacy sufficient to work with computerized technical data and information, mechanical skills, and problem-solving. Hydraulic rigs are becoming more common, requiring hydraulics training, not a requirement on conventional rigs.

The use of more technology in production comes from the need to harvest the basin using more efficient techniques. In turn, this creates a growing need for people with IT, instrumentation, Supervisory Control And Data Acquisition (SCADA), and wireless communication skills. For existing and new operations people, upgrading IT, data management and console skills will be critical. Working on trucks/wireline equipment requires more intensive training than in the past. There will be less repair maintenance and more preventative maintenance. Professional roles will continue to evolve as well. For example, reservoir engineers are becoming exploitation managers. Engineers will also need to manage energy and emissions auditing, owing to higher energy costs and environmental emission constraints arising from the Kyoto Protocol and the Clean Air Strategic Alliance (CASA). In future, more environmental approvals will be required for completions work and abandonments, and the demand for skilled environmentalists is expected to increase.

In addition, those involved in the maintenance of technology will need to be up-to-date around instrumentation, electronics, electrical and computers.

### Oil Sands – Solid Growth Phase



### Overview

Growth is the driving factor in the Oil Sands region. Production under the high case is expected to increase by 100 per cent in the next 10 years. Even under the low case scenario, production is expected to increase by 50 per cent before stabilizing during this period.

Basic expectations:

- Strong growth is projected to continue for several years;
- Production is steadily increasing each year;
- Large, multi-billion dollar projects are planned – the main concern is the inflationary trend due to the magnitude of activity;
- Investment in research and development continues to maximize production with a mix of step-change and incremental improvements;
- Management approaches will focus on developing capabilities in people, hiring new staff, and optimizing costs and production; and
- It will be important to consider the construction phases of the planned projects as labour shortages may inhibit concurrent construction or expansion of plants.

Ongoing cost pressures may have an impact on human resources, as may the entry of new Oil Sands players. A collaborative approach to managing growth will be required to ensure that sufficient new hires are attracted and that new Oil Sands ventures do not rely on borrowing talent from existing companies. Without collaborative efforts, the result will be significant upward pressures on employee costs.

### Occupational Supply/Demand Analysis

The Oil Sands region is currently expected to double its direct employment levels within the next 10 years. An estimated 8,000 positions will be created during the next 10 years. In addition, attrition due to age will affect the supply of and demand for labour. Thirty-nine (39) per cent of the current workforce is age 45 and older and for a significant number of occupational categories, the number of workers age 45 and older exceeds 50 per cent.

Based on these figures, it is highly likely that the Oil Sands region will face shortages of skilled workers in several areas during the next 10 years. In fact, no occupations in the Oil Sands are expected to be less in demand during the next decade. Occupations that face particular risk for supply gaps are heavy equipment operators, process operators, heavy duty mechanics and power engineers due to the magnitude of their projected growth (5,259 hires are forecast by 2012 over current employment levels of 2,779).

<b>OCCUPATIONS EXPECTED TO BE IN SIGNIFICANT DEMAND IN THE OIL SANDS DURING THE NEXT DECADE</b>	
<b>Position</b>	<b>Number of New Jobs</b>
Operations: Heavy Equipment Operators	2,313
Operations: Process Operators	1,433
Maintenance: Heavy Duty Mechanics	1,138
Operations: Power Engineers	375
Maintenance: Electricians	317
Maintenance: Motor Vehicle Mechanics	246
Maintenance: Millwrights	244
Maintenance: Instrument Technicians	187
Maintenance: Others	181
Maintenance: Steamfitters/Pipefitters/Gasfitters	166
Maintenance: Welders	132
Technical Engineers: Process	123
Technical Engineers: Mechanical	79
Technical Engineers: Others	63
Technical Engineers: Chemical	54

<b>OCCUPATIONS EXPECTED TO BE IN SIGNIFICANT DEMAND IN THE OIL SANDS DURING THE NEXT DECADE</b>	
<b>Position</b>	<b>Number of New Jobs</b>
Technical Engineers: Mining	53
Technical Engineers: Geotechnical	49
Technical Engineers: Environmental	45

### Shifting Skill and Competency Requirements

Growth in the Oil Sands will result in growing demand for skilled workers. The mining aspects will focus on more integration of IT and continuous improvements in efficiency and operations, as efficiency gains and improvements can have a significant impact on these projects.

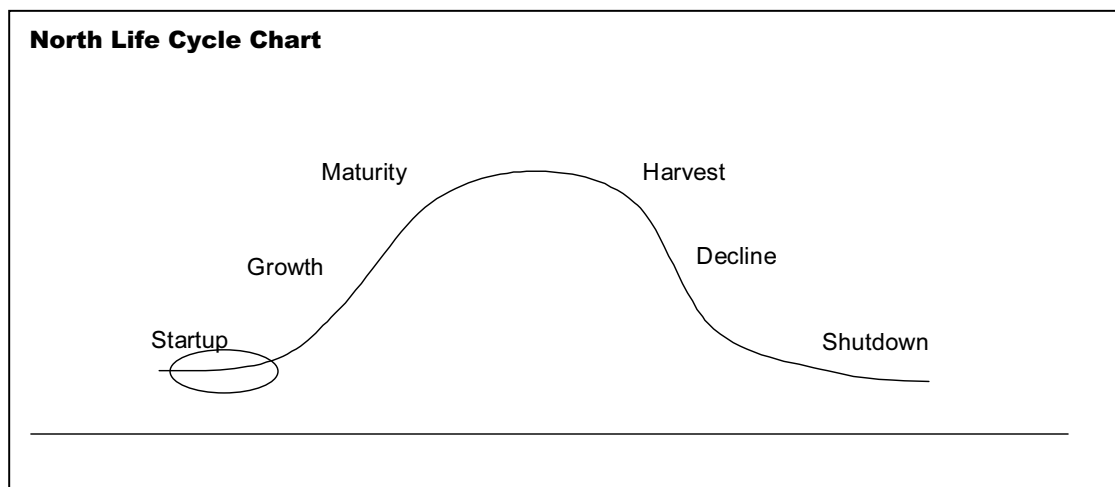
IT will continue to be an expected competency. There will be an increase in the quantity of data and the quality of data management requiring strong IT skills.

For large projects, team leaders and project coordinators will be needed to manage a large number and variety of professional and technical staff, vendors and suppliers through each phase of projects.

Safety and environmental awareness will continue to be a key competency for all workers given the size of the operations and equipment and the footprint it leaves.

The rapid growth of the Oil Sands and the challenges it faces in attracting and retaining needed skills will probably result in a need for workers to assume a much broader range of responsibilities.

### North – Early Startup Phase



## Overview

The North is in the early startup phase of the industry life cycle. Probable development of the Mackenzie Valley Pipeline by the end of this decade will incorporate leading-edge pipeline technology that will be highly efficient with a low operating cost. Operating the pipeline will require few workers due to highly automated and reliable technology. Movement into the growth phase will lead to more jobs in exploration and production when gas finds are commercialized.

Basic expectations:

- Low number of wells are being drilled annually - more activity expected once a pipeline is approved;
- Technology and processes are already well-developed from other pipelines and exploration and production;
- Region will use existing, proven technology for pipeline development;
- Little technical research and development expected, expenditures on research and development will be very low;
- Regulatory issues are very complex and the pipeline project is new for the area;
- The management approach will focus on operational excellence using proven WCSB practices and technology;
- Skill requirements in the North are consistent with those in the WCSB. The WCSB may become a source of skilled labour due to expected ongoing staff reduction in that region; and
- Construction of the pipeline will require a large number of workers, some very specialized. This will only be a requirement in the startup phase and fewer sustainable jobs are needed to operate the pipeline after it is built.

Under the high case scenario, a Mackenzie Valley natural gas pipeline could be operating by 2008/2009. Approximately 50 people would be required to operate the entire system. Approximately two hundred more will be required to operate the producing fields not including any increases due to further exploration activity.

Attracting and retaining workers will be the challenge due to remoteness and climatic conditions.

Minimizing the “boom-and-bust” economic impact for the region will be a key area of focus for industry and the community, as well as a means of ensuring employment for Aboriginal Peoples.

In some cases, Aboriginal Peoples have created sustainable employment by developing careers and businesses through service companies that support exploration and production activity. This represents a best practice for expanding the involvement of Aboriginal Peoples in the oil and gas industry.

## Occupational Supply/Demand Analysis

There is currently very little oil and gas exploration activity in the North. Employment is highly seasonal, as oil and gas activity is largely limited to the winter.

The key driver of more oil and gas development will be the building of a natural gas pipeline to southern markets. Once the pipeline is in place, the three proven onshore natural gas fields will go into production and exploration for more significant deposits is highly likely. Once in operation, approximately 50 permanent employees will be required to operate and maintain the pipeline system.

Employment levels associated with the operation and maintenance of the natural gas fields are more speculative as the technology to be used has not yet been defined. One estimate for the number of permanent positions created as a result of field operations, not including pipeline operations, is 200. This number is likely understated as the initial field development will likely be followed by more exploration and development, and therefore more operational gas fields.

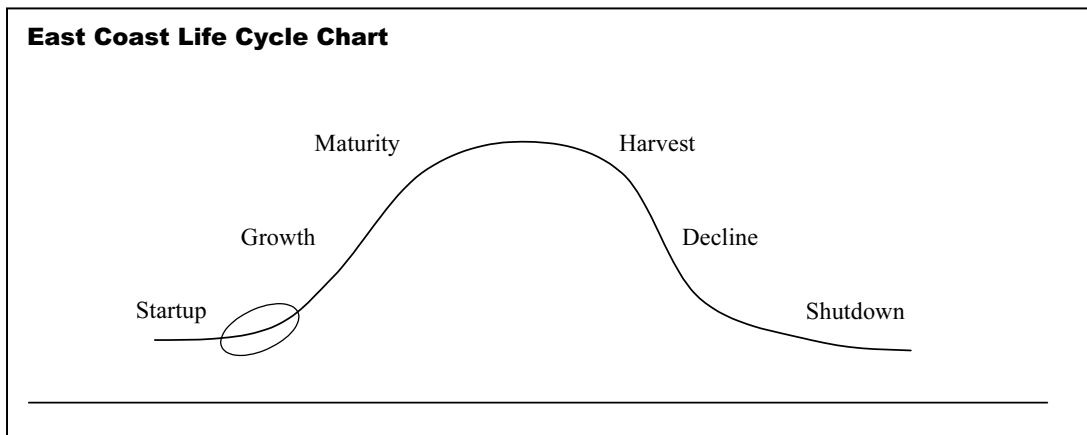
While the construction of a pipeline and related production facilities to tap into Northern gas may result in short-term labour pressures for the construction industry, the relatively small number of permanent positions to be created in the North once the pipeline starts operating, even relative to the size of the local labour pool, suggests there will not be a gap in the balance between labour demand and supply.

<b>NEW PIPELINE OPERATIONS</b>	
<b>Position</b>	<b>Number of New Jobs</b>
Foreman	3
Process/Field Operators	20
Mechanics	5
Electrical/Instrumentation	6
Technicians – General	13
Welders	3
Total	50

### Shifting Skill and Competency Requirements

According to the Mackenzie Valley Pipeline Group, the gas field operations will be automated as much as possible, reducing the need for operational personnel over the usual requirements for more conventional field operations. However, with automation comes the requirement for workers to be comfortable with technology. Although the occupations require traditional exploration and production skills, expertise and experience in harsh, cold and remote locations will be necessary.

### East Coast – Mid to Late Startup Phase



## Overview

The key driver of offshore development will be the ability of the industry to achieve and sustain exploration success and hydrocarbon resource additions. A second challenge is to streamline regulatory review through development of an integrated and co-ordinated approach that does not sacrifice public policy priorities.

The East Coast industry has the potential to have a significant economic impact on Atlantic Canada; however, the region is in mid- to late-startup phase. Drilling success must be demonstrated soon if further development is to occur.

Basic expectations:

- Policies and regulations are complex with ongoing efforts to streamline for efficiency; boundary issues within the Gulf of St. Lawrence may emerge;
- Technology will be developed, tested and demonstrated in the area;
- There is a high degree of early risk-taking and large investments are expected as potential reserves are significant;
- There is a high level of concern about environmental issues and social benefits in the area;
- The management style is one of adapting existing technologies and processes from more mature offshore areas (e.g. the North Sea); and
- As with other regions in startup or growth mode, construction is an important consideration as the industry moves along the life cycle. Predicted shortages of skilled labour and trades can affect the timing and cost of projects.

The size of the industry drives human resources issues on the East Coast. It has not attained sufficient scale to absorb enough new employees and build a sustainable talent pool. Some new graduates will be obliged to seek employment outside of the region as relevant employment is not yet available locally. There is also a shortage of workers experienced in the marine environment.

The need to streamline the complex regulatory process has been recognized and is underway. Under the high case scenario, a fourfold increase in gas production is possible. If these positive changes occur, demand for staff with critical skills and experience will be high. A specific East Coast strategy for attracting, supporting, training and developing workers is needed.

## Occupational Supply/Demand Analysis

Under the high case scenarios for Nova Scotia and for Newfoundland and Labrador, the total increase in employment over current levels is approximately 4,500 by the end of the forecast period (assuming that the high case employment peak for Newfoundland and Labrador corresponds with the end of the forecast period). This is an increase of 150 per cent – substantial, given the size of the local industry. In the low case, employment increases only marginally (about five per cent).

The significant differences between the forecasts under the high and low scenarios suggest that potential labour supply/demand gaps will be driven largely by actual industry activity levels, which will reflect the success of activity in this relatively new area. Under the high



case scenario, positions experiencing significant demand will include a range of engineering positions as well as some marine-related positions.

The current supply gaps most commonly cited for the East Coast include engineering positions, marine officer positions, drilling and rig management positions, and specialized offshore drilling and development positions. The most significant supply factor is the lack of sufficient experience in the offshore environment.

Approximately 25 per cent of the total East Coast oil and gas workforce is age 45 or older. On this basis, the aging of the workforce will not be the significant driver of labour demand that it is in other regions.

<b>OCCUPATIONS EXPECTED TO BE IN SIGNIFICANT DEMAND IN THE NEXT DECADE</b>			
<b>Nova Scotia*</b>	<b>Number of New Jobs</b>	<b>Newfoundland and Labrador**</b>	<b>Number of New Jobs</b>
General Labour	808	Deck Hand	152
Seaman	440	Second Mate	41
Engine Room Operator	196	Engineering Technologist/Technician	39
Welder	181	Production Technician	36
Rigger	136	Captain/Master	34
Ships Officer	127	Chief Engineer`	34
Caterer	124	First Mate	34
Pipefitter	115	Second Engineer	32
Electrician	108	Instrumentation/Electronics Technician	30
Plater	105	Surveyor Technologist	27
Barge Engineer	48	Instrumentation/Controls Engineer	11
Well Engineer	37	Fourth Engineer	10
Marine Engineer	33	Third Engineer	10
Drilling Engineer	30		
Geologist	22		
Structural Engineer	20		
Engineering Management	17		
Mechanical Engineer	10		
Process Engineer	10		
Piping Engineer	8		
Electrical Engineer	7		
Civil Engineer	3		
Corrosion Engineer	1		

\*Moderate/high case scenario positions showing greatest increase in demand from 2002 to 2012.  
 \*\*High case scenario (three Floating, Production, Storage and Offloading (FPSO) vessels).

## **Shifting Skill and Competency Requirements**

As the East Coast offshore continues to develop, project management will be a critical skill. Computer literacy is an absolute requirement not only for engineers and geoscientists, but also for personnel involved in all aspects of operating and maintaining offshore exploration and production.

Environment, health and safety will continue to be a significant focus on the East Coast, particularly the cumulative effects of oil and gas exploration and production in the area. This will require that the entire workforce possess a broad awareness of issues and related precautionary actions.

Robotics may play a larger role, too. For example, smart tools and equipment such as mini-submersibles and remote operating vehicles (ROVs) could be used for the inspection of pipelines and facilities, remote access to wellheads, and sub-sea maintenance and repair.

### 3. CHOOSING OUR FUTURE

This section of the report provides human resources strategies that may be appropriate for implementation during the next 10 years. These potential ways of resolving issues are either called **recommendations**, meaning they fall within the mandate of the Petroleum Council, or **considerations**, denoting those ideas and suggestions that other stakeholders may wish to consider for implementation.

#### Recommendations

#### KEY ISSUE 1: PROMOTING CAREERS IN THE INDUSTRY

Attracting new employees into the industry will be critical to getting the right skills to the right region when they are needed. New entrants in some key occupations are needed within the WCSB as well as within the frontier and new production regions to ensure that expected labour demand can be met under probable economic scenarios.

#### RECOMMENDATION #1 (Attraction & Selection)

Within each region, develop an information strategy to communicate with potential entrants, their parents and others who play a role in influencing career choices. The strategy may include approaches such as the development of a website, participation in career fairs, servicing career practitioners, or targeted marketing. It should provide information about the industry, its career opportunities, and education and skill requirements to potential entrants. The information should be tailored to address issues specific to each region.

#### RECOMMENDATION #2 (Training & Development)

Collaborate with the K-12 education system to explore opportunities for industry to provide practical application examples for curriculum so that students and educators can obtain a better understanding of how math and science are applied.

#### KEY FINDINGS/ANALYSIS

##### Industry-wide

- The ability of industry to attract high achievers is dependent on the degree to which those individuals believe a career in oil and gas provides long-term rewards.
- The industry requires new entrants into petroleum-related trades; drilling; seismic and services careers/occupations to meet current as well as future demand.
- Years of industry restructuring have created the perception that the industry is unstable; this perception must be overcome.
- A major barrier to selection of apprenticeship and trades as a career option for students is the lack of encouragement from their parents to enter trades as a profession.

## **KEY ISSUE 1: PROMOTING CAREERS IN THE INDUSTRY**

### **WCSB**

- WCSB restructuring and downsizing over the past several years have created a negative image of the industry among new graduates. The industry may not be recruiting sufficient new graduates in key technical areas such as engineering and geology to provide a stable profile for career development. Foreign worker exemption information suggests some of these key technical areas are already experiencing shortages.

### **Oil Sands**

- An impending labour shortage in key skill areas will result due to rapid growth and an aging workforce.

### **North**

- A northern workforce must be attracted, developed and sustained to support predicted industry activity.
- More effective preparation of Aboriginal Peoples for entrance into training programs is needed.

### **East Coast**

- The East Coast high case demand scenarios create significant labour demand that is not currently met in the region.
- A history of raised and subsequently dashed expectations about the industry on the East Coast has created some public skepticism. There is a need to develop a solid understanding of the industry among the general public to improve its image.

## **KEY ISSUE 2: ACCESS TO NON-TRADITIONAL WORKFORCE**

The industry is under-utilizing potential sources of labour including women, Aboriginal Peoples, and new immigrants. There are barriers to entry into the upstream petroleum industry for all of these groups that must be addressed before they can be considered a ready source of new labour that helps to meet demand.

### **RECOMMENDATION #3 (Attraction & Selection)**

Work with industry to attract under-represented groups (e.g. women, Aboriginal Peoples, immigrants) to augment the traditional labour pool and provide access to employment to these groups by:

- Increasing the exposure of the industry as a viable option at an early age (K-12) to counteract pre-conceived notions regarding careers.
- Encouraging stakeholders to collaborate in the development and support of mentorship and role modelling programs.

### **RECOMMENDATION #4 (Retention)**

Work with industry associations and stakeholder groups to establish industry standards and resources (such as harassment policies) that foster a respectful work environment to attract and retain a non-traditional workforce.

### **RECOMMENDATION #5 (Training & Development)**

Develop a standard assessment tool and program model to be used to develop targeted programming that addresses attraction and retention barriers for non-traditional workforces. Components to consider include: education upgrading, technical skill development, language skills, employability/essential skills.

### **RECOMMENDATION #6 (Labour Market Entry)**

Facilitate discussion among stakeholders to develop targeted prerequisite and bridging programs that meet the cultural needs of the Aboriginal Peoples and the occupational needs of the region so that Aboriginal candidates qualify for training and employment opportunities.

### **RECOMMENDATION #7 (Retention)**

Evaluate current approaches to the retention of Aboriginal workers to improve retention and career progression in preparation for increased participation in the workforce.

### **RECOMMENDATION #8 (Attraction & Selection/Retention)**

Work with government, industry and immigrant associations to identify barriers and support solutions for new immigrants that attract and retain immigrant workers for work in locations outside of the existing support infrastructure (main population centres).

## KEY ISSUE 2: ACCESS TO NON-TRADITIONAL WORKFORCE

### RECOMMENDATION #9 (Labour Market Entry)

Work with government, industry and stakeholder associations to integrate and provide access to information and contacts with respect to recognition of foreign education and/or experience in Canadian oil-and gas-related professional and trade associations.

### KEY FINDINGS/ANALYSIS

#### Industry-wide

- Need to attract new entrants to some key occupations, as well as to frontier and new production regions, to ensure that expected labour demand can be met under probable economic scenarios.
- Systemic barriers are still blocking the petroleum industry's access to potential labour pools (e.g., new immigrants, Aboriginal Peoples, women). This must be addressed before they are likely to become a ready source of new labour to address labour demands.
- For the "in-scope occupations" women make up approximately 20 per cent of the upstream petroleum workforce; immigrants and visible minorities 14 per cent and Aboriginal Peoples only five per cent.
- Canadian immigrants with foreign credentials and work experience do not assimilate easily into the Canadian upstream oil and gas industry.
- The growth rate of the Aboriginal working age population is five times that of the general population. This rapid growth may prove a boon for the industry, especially in remote regions.
- Barriers to entry for non-traditional labour sources include:

#### Women:

- Limited role models and mentors.
- Lack of information and exposure to related careers.
- Perceptions and myths such as the work is too physically intensive.
- Attainment of prerequisite high school courses such as math and science.
- Societal myths re: men's work and women's work

#### Aboriginal Peoples:

- Limited of role models and mentors.
- Lack of information about and exposure to related careers.
- Attainment of prerequisite high school courses such as math and science.

#### Immigrants:

- Limited of role models and mentors.
- Process of re-qualifying based on their previous educational attainment and experience is cumbersome.
- Cultural barriers such as language skills, Canadian work culture expectations, and adjustment to Canadian society.
- Insufficient preparation prior to entry for the rigorous re-qualification process that will be required.

## KEY ISSUE 2: ACCESS TO NON-TRADITIONAL WORKFORCE

### WCSB

- The regulatory process requires consultation with local stakeholders and Aboriginal communities regarding industry activities and agreement on how local communities may participate and benefit from industry. In many communities, there is a skills availability gap between what is required to participate in the industry and what is available; therefore, local labour market development and planning is required to fulfill regulatory commitments.

### Oil Sands

- Growth is the driving factor in this region. Production under the high case is expected to increase by 100 per cent in the next 10 years. Even under the low case, production is expected to increase by 50 per cent and stabilize during this period. Tapping into under-utilized labour pools will be critical in ensuring continued supply of labour.
  - Enrolment rates into training programs for high demand occupations must increase to meet labour demand.

### North

- Aboriginal Peoples make up 46 per cent of the workforce in the North. Greater participation of Aboriginal Peoples in the North is critical to supplying the industry with the workforce required.
- Aboriginal Peoples, as well as other northern residents, will likely be key resources as the industry employment demand grows as they are already acclimated and are geographically proximate. However, this will require addressing current barriers to labour market entry such as lack of understanding of careers and entry-level skill requirements, and lack of attainment of prerequisite courses for post-secondary training.

### East Coast

- Benefit plans require industry to ensure provincial residents are given full and fair opportunity and first consideration for training and employment. There are particular provisions to ensure under-represented groups have access to training and employment opportunities. This often takes the form of a diversity plan for a project.
- The East Coast offers programs exposing women to trade and technology occupations in the resource sector with a positive impact on women entering post-secondary training for these occupations. Barriers to transitioning into the workplace still exist, affecting the number of women working in the industry.
- Mobility barriers for women on the East Coast are significant obstacles to female participation in the industry.

### **KEY ISSUE 3: SKILLS SHORTAGES**

Research indicates there are a number of occupational areas that are either currently facing skills shortages or will face skills shortages. The current shortage of trades workers will be worsened by heavy construction cycles in both the oil and gas industry and other industries. A critical shortage of heavy equipment operators, process operators, heavy duty mechanics and power engineers will occur with the growth of the Oil Sands. The industry currently experiences shortages of workers in drilling, and the seismic and service sectors. “Hot Skills” continue to materialize and must be addressed in more creative ways than in the past.

#### **RECOMMENDATION #10 (Training & Development)**

Work with industry to establish occupational standards, apprenticeship, competency, and certification and training programs for occupations where supply gaps exist or will exist to improve workforce mobility, career path options and training consistency.

#### **RECOMMENDATION #11 (Attraction & Selection/Training & Development)**

Develop prior learning assessment tools to assess the skills of the semi-skilled workforce to improve attraction and retention and to streamline the selection process.

#### **RECOMMENDATION #12 (Labour Market Entry)**

Explore potential partnerships to share labour resources with industries that operate during the WCSB off-season and experience the same challenge of attracting and retaining workers.

#### **RECOMMENDATION #13 (Training & Development)**

Conduct an analysis of the completion rates for oil and gas related apprenticeships (generally low) to identify the reasons, barriers and opportunities to increase overall journey certified workers.

### **KEY FINDINGS/ANALYSIS**

#### **Industry-wide**

- Although the issues associated with new construction are outside the scope of this study, it is clear the magnitude of the projects will create pressures on the supply of trades workers – a significant segment of the oil and gas industry.
- Foreign worker exemptions indicate shortages and difficulty in recruiting a number of engineering, technologist and technician occupations across all industries in Canada.
- An increase in enrolments and completion for trades programs is required to address labour shortages in these occupational areas. The completion rates for trades have declined significantly over the past decade.
- The whole industry will experience pressure on some operations and trade occupations because of the high growth rate in the Oil Sands.



## KEY ISSUE 3: SKILLS SHORTAGES

- While there has been a general aging of the working population, the decrease in hiring new graduates for a significant number of years has worsened concerns about shortages of replacements for the aging baby boomer population that represents a significant percentage of the total working population of the oil and gas industry.

### WCSB

- Labour shortages and high turnover rates currently exist in the drilling, services and seismic sectors. In the high case scenario, these sectors are likely to continue to experience labour shortages.
- Risks associated with high turnover rates include safety and productivity concerns.
- Contributing to attraction and retention issues identified for entry-level positions in the drilling, service and seismic sector are:
  - A lack of awareness of entry-level requirements for the upstream petroleum industry.
  - Seasonality/cyclical nature of the business resulting in workers not seeing the work as long-term career/employment opportunities.
  - Traditional labour pool these sectors draw from (rural/farmers) has declined.
- To address attraction and retention concerns, the Petroleum Services Association of Canada (PSAC) and the Canadian Association of Oilwell Drilling Contractors (CAODC) are developing competency-based programs to recognize the attainment of occupational skills by either a certification or a trade designation. As well, they and other industry associations are looking at ways to optimize the industry's drilling cycle. Continuation of these strategies is seen as key to attraction and retention of a skilled workforce and mitigation of the risks to the industry associated with shortages and turnover.

### Oil Sands

- A critical shortage of heavy equipment operators, process operators, heavy duty mechanics and power engineers will occur without more targeted training of potential candidates, including increasing the enrolment and completion of programs related to these occupations.

### North

- The skills required by the industry operating in the North are the same as those of the WCSB; therefore, the North will benefit from any efforts to address attraction and retention issues associated with the drilling and service workforce.

### East Coast

- The marine industry faces a shortage of senior personnel for operation of supply vessels.
- Supply gaps most commonly cited for the East Coast include engineering positions, marine officer positions, drilling and rig management positions, and specialized offshore drilling and development positions.
- Requirements of Benefit Plans to contribute to education and training on the East Coast provides an opportunity to address human resource issues.

## **KEY ISSUE 4: LABOUR MARKET INFORMATION GAPS**

There is no regular industry-wide forecast of labour supply/demand that provides labour market information from a national perspective. Access to such information would enhance educational program alignment with industry needs and facilitate the ability of industry to analyze high demand occupational risks and respond with strategies that may alleviate the pressure an aging population places on the industry.

### **RECOMMENDATION #14 (Information, Strategy and Planning)**

Collect and analyze data on an ongoing basis on labour demands mapped to NOC codes or industry-identified categories (e.g. as done by the Regional Issues Working Group (RIWG) for Oil Sands) so that gaps in supply are identified and annual action plans developed to address the gaps.

- e.g. getting industry cooperation to contribute to databases; further identify gaps in current data collection and address the gaps.

### **RECOMMENDATION #15 (Information, Strategy and Planning)**

Establish a forum of educators and industry to consider the potential for developing a national strategy on the delivery of oil and gas programs so that appropriate technical and/or academic programs are identified and strengthened or developed to address workforce demands of the industry.

### **RECOMMENDATION #16 (Information, Strategy and Planning)**

Develop an understanding of the nature and composition of the contractor workforce to better prepare for issues that may arise with skill shortages.

## **KEY FINDINGS/ANALYSIS**

### **Industry-wide**

- The education infrastructure in Canada can cope with the labour demand requirements even under the high case scenario. However, industry, governments and educational institutions must collaborate so that programs are supported and the supply of candidates matches demand. In some cases, barriers to entry to programs must be reviewed and modified to ensure an adequate supply of new entrants.
- The oil and gas industry requires highly skilled workers with training provided by colleges, vocational institutes or universities. Labour demand information assists these institutions with their strategic planning.
- While the education of the workforce nation-wide may offset many attrition issues, there are still “hot skill” occupations that need to be addressed.
- Outside of the Oil Sands, the issue of retirement among the baby boom generation is beyond the 10-year scope of this study. Still, it is crucial that human resources practitioners recognize the current decade as a grace period rather than a reprieve from this serious issue. Organizations have the time required to segment their workforce, analyze the high demand occupational risks, and respond with succession and workforce planning that may alleviate the pressure an aging population will place on industry.

## KEY ISSUE 4: LABOUR MARKET INFORMATION GAPS

- Industry's ability to perform critical human resources analysis quickly is hampered severely by the poor quality of existing human resources data. The East Coast; Oil Sands and North regions have addressed this issue well and created means of predicting demand scenarios; however, most current jobs are in the conventional industry of the WCSB and it does not have effective, accessible and repeatable sources of employment information.

### WCSB

- WCSB restructuring and downsizing has created a negative image of the industry among new graduates.
- The industry may not be recruiting sufficient new graduates in key technical areas such as engineering and geology to provide a stable demographic profile for career development.
- While the demographic analysis suggests retirement of skilled workers will not be an issue in this decade, many critical in-scope occupations have more than 40 per cent of the labour force age 45 and older.
- The data currently available, generated through this study for the WCSB, is based on NOC codes. Companies report that the NOC codes are not relevant to the occupations. The response rate to this study's request for data via the headcount survey was not adequate to utilize for supply/demand forecasting. The process could have created a foundation of effective repeatable employment data had the industry been fully engaged.

### Oil Sands

- An impending labour shortage in key skill areas will result due to rapid growth and an aging workforce. More targeted training of potential candidates in particular skills sets is required. The employment forecasting information compiled by the RIWG in Fort McMurray has provided the information required for both industry and education and training institutions to begin to prepare for the future.

### North

- The training program developed by the Pipeline Operations Training Committee (POTC) can be used as a best practice for the development of a labour pool. The process developed by POTC identifies the positions, develops training profiles, identifies training institutes as partners, establishes selection criteria and develops a timeline for program implementation that coincides with real demand for workers that can effectively address resourcing challenges.

### East Coast

- Recent labour demand studies done by the Petroleum Research Atlantic Canada (Nova Scotia) and Petroleum Industry Human Resources Committee (Newfoundland) provided information for this study that assisted in creating the national upstream petroleum labour supply/demand picture.
- If streamlining of the regulatory process occurs and the high case scenario is realized, demand for staff with critical skills and experience will be high. A specific East Coast strategy for attracting, supporting, training and developing workers is needed.
- The East Coast high case demand scenarios create significant labour demand that is not met in the region, potentially impacting the ability of industry to undertake planned activities.
- A shortage of local candidates with sufficient offshore experience creates labour supply issues that cannot be filled by new graduates.

## **KEY ISSUE 5: SHIFTING SKILL REQUIREMENTS**

Composition and competency requirements of positions within the upstream petroleum industry will change in response to changing technology and the business and regulatory environment. Employers are accountable to demonstrate their employees are competent and to provide development support. This can place a significant burden on companies, especially smaller companies with few or no designated training personnel.

### **RECOMMENDATION #17 (Training & Development)**

Collaborate with educational institutions to identify the key training needs of each sector and identify opportunities for local colleges, institutes and universities to provide training to employees.

### **RECOMMENDATION #18 (Attraction & Retention)**

Establish baseline or entry requirements for workers so there is greater awareness of the requirements of the industry (e.g. essential employability skills; mandatory certificates or training; other aptitudes).

### **RECOMMENDATION #19 (Training & Development)**

Develop a common set of leadership skills, competencies and personal attributes so a pool of future leaders can be developed to ensure operational excellence within the industry.

### **RECOMMENDATION #20 (Training & Development)**

Develop and implement flexible learning approaches including e-learning and distance delivery so that workers, especially in remote locations, have access to ongoing training and development opportunities.

## **KEY FINDINGS/ANALYSIS**

### Industry-wide

- While some sectors in the industry draw from the “unskilled labour pool” for entry-level positions, those positions still require essential employability skills such as mechanical aptitude as well as mandatory safety training; therefore, the number of those qualified for entry into the industry from the “unskilled labour pool” is very small.
- There is a lack of awareness of entry-level requirements for the upstream petroleum industry.
- Some regulations, such as Onshore Pipeline Regulations, demand that training programs that ensure competency of operations staff are the responsibility of the employers.
- Many smaller oil and gas companies do not have training departments. Most larger oil and gas companies outsource their training activity. This gives rise to the potential for industry-wide solutions that alleviate the burden from a single company – especially smaller companies – while promoting consistency in training and mobility.
- Many companies report leadership development as a major focus area.

## **KEY ISSUE 5: SHIFTING SKILL REQUIREMENTS**

- There are a variety of best practices illustrating industry-wide solutions to shifting skill requirements. For example: Petroleum Services Competency Program; common safety and accreditation standards by the Oil Sands Safety Association; Canadian Association of Oilwell Drilling Contractors' apprenticeship program (pending) for oilwell drilling occupations; Canadian Association of Petroleum Producers' "East Coast Offshore Petroleum Industry: Training and Qualifications" publication.
- As industry focuses on continuous improvement or operational excellence to meet ongoing operational challenges and looks to new technology to improve efficiency, skills and competencies such as technology/computer proficiency, interpersonal/problem-solving, business skills/literacy, and cross-functional skills that allow employees to address broader roles are seen as key to success for the industry.
- The expansion of the industry into remote regions results in more employees located remotely from education and training institutes, creating further barriers to necessary training and education. This is particularly true for Aboriginal communities.

## **KEY ISSUE 6: MOBILITY OF WORKFORCE**

The mobility of some current and future employees will be a key factor in getting the right skills to the right regions when they are needed.

### **RECOMMENDATION #21 (Attraction & Selection/Retention)**

There is a need to employ strategies to attract, develop and sustain an appropriate workforce in remote areas to ensure an adequate supply of continuous labour. This could include pre-assessment tools and screening practices that involve educating candidates and their families about the realities of the work and social environment.

### **RECOMMENDATION #22 (Retention)**

Trades that are part of the upstream petroleum sector should be included in the Red Seal Program. Trades workers should be encouraged to get their inter-provincial or inter-territorial tickets, so that labour mobility and the ability to meet regional demand are enhanced.

## **KEY FINDINGS/ANALYSIS**

### Industry-wide

- To meet demand, inter-provincial and inter-territorial mobility of qualified trades is a must. This would ensure that labour supply and demand is better balanced. Some oil and gas trades are not included in the Red Seal Program (which promotes inter-provincial and inter-territorial mobility) in some provinces and territories.
- Mobility of trades qualifications through the Red Seal Program requires increased participation.
- The most pressing needs are for practices that attract and retain key talent to the industry in general and to remote, sometimes harsh locations in particular. Companies are competing for talent that does not require remote relocation. The key to attracting such candidates is creating and sustaining a positive image of the industry as a desirable place to work, one that facilitates mobility and provides effective training and development.
- The requirement to live and work in remote locations for career progression can be a disincentive for new graduates considering the petroleum industry, when compared to industries that operate only in major urban centres.
- A key issue around mobility is the dual career family. The issue is exacerbated by the movement to remote locations where opportunities for spouses are limited.

### WCSB

- Industry reports recruitment and retention is difficult for specialized skill areas as well as for geographic areas considered “remote”.

## KEY ISSUE 6: MOBILITY OF WORKFORCE

### Oil Sands

- The size of the workforce in the Oil Sands will double in the next 10 years. This demand will be exacerbated by attrition due to an aging workforce. Additional barriers to attraction to the Oil Sands industry, situated in Fort McMurray, are remoteness, the high cost of living, and the housing shortage.

### North

- Industry reports the need for focused recruitment and retention strategies for work in the NWT. Aboriginal Peoples, as well as other northern residents, will likely be key resources as they are already acclimated and close by.
- Opportunities for dual-career families to get employment will be needed so as not to exclude individuals from the workforce.

### East Coast

- The East Coast high case demand scenarios create significant labour demand that is not met in the region, potentially impacting the ability of the industry to undertake planned activities.
- Some conditions of Benefit Plans can act as barriers to mobility of workers to the East Coast.

## **KEY ISSUE 7: CREATIVE HUMAN RESOURCES PRACTICES**

The oil and gas industry has traditionally responded to labour shortages or other human resources pressures with highly competitive compensation programs. As the implications of a changing competitive environment become clear and companies try to reduce costs while improving performance, attraction of people with critical skills will be the challenge and the industry will need creative solutions to develop and implement human resources programs to foster attraction and retention.

### **RECOMMENDATION #23 (Information, Strategy and Planning)**

Establish a central source to collect and communicate best practice information, thus facilitating industry and stakeholder access of this information.

### **RECOMMENDATION #24 (Retention)**

Work with stakeholders to assess and share best practices information and develop workplace integration programs for attraction and retention of non-traditional workforce into the industry.

### **RECOMMENDATION #25 (Retention)**

Find ways to keep at least a core northern workforce employed year-round to keep northerners engaged in the industry, provide year-to-year continuity and allow for career development and employee retention.

### **RECOMMENDATION #26 (Labour Market Entry)**

Work with industry to ensure openings for on-site work experience and internships. Create a clearinghouse for educational institutions and employers to list workplace experience opportunities for students. (e.g. companies active in the East Coast offshore industry provide work experience for recent graduates).

## **KEY FINDINGS/ANALYSIS**

### Industry-wide

- It is critical that industry be able to attract and retain top talent. The key to this is creating and sustaining a positive image of the industry. The industry may be mature in the WCSB but the other regions present growth opportunities and, therefore, the potential for long-term careers. The ability of industry to attract high achievers is dependent on the degree to which those individuals believe a career in oil and gas provides long-term rewards.
- The most pressing needs are for practices that attract and retain key talent to the industry in general and to remote, and sometimes harsh, locations in particular. The key to attracting such candidates is creating and sustaining a positive image of the industry as a desirable place to work, one that facilitates mobility and provides effective training and development. Years of industry restructuring have created the perception that the industry is unstable, which affects its ability to attract new employees.
- Companies are competing for talent with industries that do not require remote relocation.
- The oil and gas industry needs to be proactive in managing the rate at which employees retire so that the labour supply does not fall short of demand.



## KEY ISSUE 7: CREATIVE HUMAN RESOURCES PRACTICES

- Addressing some issues will require new approaches to human resources management. There are a significant number of petroleum and other industry best practices that could assist the upstream petroleum industry with current and future human resources issues.
- There is consensus among industry and training providers that co-op programs are an integral part of the experience students need to translate formal education into practical knowledge. Co-op programs are offered at most institutions that provide graduates to the oil and gas industry and are, in fact, a preferred hiring consideration. However, the industry has decreased its participation, citing difficulty providing mentoring by employees.
- The number of co-op programs and the need for co-op placements has increased.
- Oil and gas co-op placements are an excellent opportunity to promote the industry to students and create skilled labour supply.
- Co-op programs are expensive for institutions.
- Similar skill requirements across the different sectors result in a high degree of employee mobility within the industry. This has resulted in a more homogenous approach to human resources policies and practices as companies compete for talent. This will need to change as the industry moves to more remote and diverse areas of the country.

### WCSB

- The use of compensation to attract and retain employees becomes less sustainable as the industry enters a harvest period and as operational efficiency becomes a key strategy.

### Oil Sands

- Ongoing cost pressures may affect human resources, as may the entry of new Oil Sands players. A collaborative approach to managing growth will be required to ensure that sufficient new hires are attracted and that new Oil Sands ventures do not rely on borrowing (buying) talent from existing companies. This phenomenon has occurred in the WCSB for a number of years.

### North

- Oil and gas companies that operate in the North compete with the mining industry for similar skills and competencies. The mining industry is seen as more stable because it is not seasonal and does not require mobility.

### East Coast

- At current industry activity levels, attraction and retention have not been identified as a human resources issue for the East Coast. However, if the high case scenario is realized, demand for staff with critical skills and experience will be high and a specific East Coast strategy for attracting, supporting, training and developing workers will be required.
- The most significant supply factor is the lack of sufficient experience in the offshore environment.

## Considerations

As the remaining recommendations come under the mandate of industry, government, education institutions and corporate human resource departments. They are offered only as considerations for those stakeholders.

The themes section of this report identified four over-arching themes that emerged from the analysis. In the section below, both industry-wide and regional considerations are presented thematically.

## Collaboration

**There is a pronounced need for co-ordination and collaboration among industry associations, all levels of government, educational institutions, private training service providers, unions, and industry.**

### Industry-wide

- Industry and educational institutions are encouraged to work with government to increase financial support and the number of qualified instructors so that students have access to educational programs that foster key skill sets.

### North

- To encourage a legacy of economic development and to avoid the boom-and-bust cycle, industry should continue to strive for lasting partnerships with Aboriginal-owned organizations and with Aboriginal communities to support the creation of related business development such as the service industry. This practice has been successful in northern Alberta.

### East Coast

- A shortage of local candidates with the required degree of offshore experience creates labour supply issues that cannot be addressed by new graduates. Ideally, provincial governments in the region would provide incentives to industry to create new opportunities for graduates in the region. Regulators might reconsider whether migrants who seek experience outside of the region and later return can be considered to be native;
- Mobility barriers on the East Coast impair the successful participation of women in the industry. To encourage and promote the development of women in trades, government should consider providing additional support to the programs in place that address barriers to mobility and practical experience;
- The current regulatory process in the East Coast is complex and burdensome. Government, industry and other stakeholders should continue to collaborate to review and streamline regulatory processes. A significant step forward was taken in November of 2002 when four federal ministers, three provincial ministers from Nova Scotia, Newfoundland and Labrador and New Brunswick, and senior members from the Canadian Association of Petroleum Producers, the Newfoundland and Labrador Offshore Industry Association and Offshore/Onshore Technologies Association of Nova Scotia met to advance offshore oil and gas issues in the Atlantic region.

## Excellence

**Human resources professionals and company leaders must adopt best practices that allow companies to attract talented individuals, retain them at challenging remote locations, and facilitate their unrestricted movement from one region to another.**

The key challenges include the issues identified under the talent management model. Strategies should address the changing human resources dynamics such as attraction, retention, gathering labour market information, migration of employees to frontier and new production regions, and training and development as it relates particularly to safety and environmental regulations.

### Industry-wide

- To encourage new entrants – especially university and technical school graduates – into the petroleum sector, government should consider increased funding to colleges and institutions to offset the cost of running co-op programs.
- Industry has typically depended on generous compensation and benefits programs to solve human resources issues. To address its resourcing issues in the future, companies might consider more holistic approaches and the adoption of best practices in attraction and retention to address supply issues and business needs;
- As e-learning or self-directed learning becomes more common, and to encourage continuous learning and maintenance of required competencies, employers should commit to putting aside work time to accommodate specific training programs;
- Human resources departments should consider succession planning for positions where workforce segmentation, attrition analysis and labour supply pressures (e.g., Oil Sands growth; marine positions) indicate a labour shortage may occur so that industry and companies can develop and implement timely and effective human resources strategies.

### North

- To draw employees to the North and retain them, employers are advised to develop practices that encourage dual career families to locate in remote areas (e.g. partnering with other organizations that may have opportunities, job search assistance or distance learning support);
- The training program developed by the Pipeline Operations Training Committee (POTC) can be used as a best practice for the development of a labour pool for field staff, and needs to be supported by both industry and government as the North develops. The process developed by POTC identifies the positions, develops training profiles, identifies training institutes as partners, establishes selection criteria and develops a timeline for program implementation that coincides with real demand for workers that can effectively address resourcing challenges.

### East Coast

- The marine industry faces a shortage of senior personnel for operation of supply vessels. A formal career progression model for high-potential marine officers and new graduates would facilitate the supply of senior officers.

### Oil Sands

- To ensure retention of key people resources, existing Oil Sands operators should consider longer term resourcing strategies that mitigate the impact of cost-cutting measures on their workforce;

- Industry should consider the development of comprehensive resourcing plans to encourage attraction and retention of labour to the Oil Sands. Resourcing plans can include support for apprenticeships and trades through bursaries, co-op positions and summer jobs, the extension of the aging workforce (in essence, re-recruiting the older workforce), effective integration of contractors, on-site training and development, and flexible work schedules.

#### WCSB

- To develop a proactive approach to the impending age attrition issue, industry might encourage longer careers for older workers and facilitate mentoring of younger workers. The best practice section of this report provides specific examples;
- Contract employees now comprise at least 9 per cent of the industry workforce. To manage contractors, human resources practices that encourage retention and mobility of these workers need to be considered. Some existing practices include completion incentives and preferred contractor status if contractors are willing to work in remote locations;
- To fully utilize experienced or older workers, industry could identify mechanisms that provide incentives to employees eligible to retire so that labour supply and demand can be more effectively managed. Mechanisms the industry might consider include phased-in retirements, more widespread use of part-time employment, and a career path that includes mentorship.

#### Sustainability

**To grow and prosper, industry must have access to vital resources when it needs them. Those resources take many forms, including natural resources, innovative technology, investment capital, and human resources. The sustainability of the industry therefore depends, in part, on the identification and resolution of human resources challenges.**

#### Industry-wide

- To offset costs for students and to expose them to industry, the number and value of industry-sponsored bursaries and scholarships and apprenticeships might be increased for targeted disciplines or learning streams.

#### North

- To support the involvement of Aboriginal Peoples in the North, oil and gas companies (E&P and service) are advised to understand the cultural complexities and needs of the North. By doing so, customized programs/processes can be developed that support the involvement and attraction of Aboriginal Peoples in the industry.

#### East Coast

- To address resourcing and supply issues in the East Coast, benefit plans might be managed and interpreted to ensure that when labour shortages exist, workers can be utilized from other regions.

#### Oil Sands

- To encourage the migration and availability of a skilled and potential workforce to the Oil Sands region, local government and industry should consider a set of solutions that addresses the severity of the housing shortage through more

construction. In addition, construction of on-site mobile facilities and the use of rotational shifts (such as eight days on, six days off) have proven effective in many remote conventional operations.

## Optimization

**Industry optimization must be transformed from a short-term reactive approach to a proactive, long-term strategy.**

### WCSB

- To address the human resources issues inherent in changes resulting from restructuring, industry stakeholders are encouraged to work more collaboratively in the future. While several issues can be addressed in the near-term, others are clearly of longer duration.

## What next?

The Petroleum Human Resources Council of Canada was established to be a catalyst for change and a vehicle for collaborative action that assists the upstream petroleum industry in continuing to develop a qualified, motivated and agile workforce.

This study underscores the importance of collaborative efforts. In industries where the business environment is highly competitive, such as the oil and gas industry, collaboration can be difficult to achieve. The Petroleum Council, whose leadership structure incorporates all sectors of the industry in Canada, including workers, is well positioned to lead in building collaboration, broad stakeholder involvement and improved connectedness in the industry.

Now that this study and consultation with the Steering Committee has resulted in recommendations and considerations to address human resources issues within the industry as a whole and within the regions, the Petroleum Council will host a series of events to provide industry and other stakeholders with the opportunity to participate in and learn about the study findings, issues and recommendations. The events include:

- a series of regional meetings for industry and other stakeholders at Fort St. John, BC; Inuvik, NT; Fort McMurray, AB; Calgary, AB; London, ON; Halifax, NS; and St. John's, NL; and
- meetings with the Petroleum Council member organizations.

In hosting these events, the Council will work closely with industry, funding partners and other stakeholders to set priorities, and develop and implement action plans that address the human resources issues identified in the study on a priority basis.

The plans will be presented at two launch events:

- an information breakfast for executives from industry, funding partners and other stakeholder groups; and
- an information lunch for interested stakeholders.

The action plans will be part of a broader national upstream industry human resources strategy that will address critical issues and build a platform for future industry growth and sustainable, attractive employment.

## 4. BEST PRACTICES IN HUMAN RESOURCES

The operational excellence model reviewed earlier is an approach industry has taken to improve the efficiency and effectiveness of their products and service delivery. Best practices in many disciplines have come from this focus on continuous improvement.

This section of the report provides a sampling of relevant human resources best practices from leading organizations of all types and best and unique human resources practices from within the upstream petroleum industry itself. The Human Resources Talent Management model has been used to group the best practices. Among these examples are practices that, with appropriate modification, may provide a foundation for future human resources planning within the industry.

### **The Best Practices – Lessons from Leading Organizations**

#### **Information, Strategy and Planning**

Leading organizations utilize information to inform the development of strategy and plans to align with broad organizational goals.

- Have a clear talent management strategy and build talent management as an essential capability within the organization;
- Use technology to streamline processes and information sharing, so effort can be focused on the more critical “high touch,” or one-on-one aspects, of recruiting, onboarding (helping new hires become acclimated to company culture), and assimilation; and
- Engage employees in the business and create a clear line of sight between what employees do every day and how the organization performs.

#### **Labour Market Entry**

Leading organizations address human resource supply issues by preparing their business environment to facilitate the smooth transition of diverse new entrants into the organization.

- Collaborate with Aboriginal communities to promote employment of Aboriginal Peoples;
- Integrate diversity in the business mission, vision and values;
  - Including a broad, inclusive concept of diversity
  - Tied to business objectives, goals and plans generally, not just those concerning human resources
- Maintain a clear focus on attaining a diverse, representative workforce;
  - A diverse workforce and a high quality workforce are seen as “two sides of the same coin”; and
- Tailor diversity practices by and to business units.

## Attraction and Selection

With respect to attraction and selection, a strategic approach to recruiting is the cornerstone of talent management efforts. Rather than focusing on "filling jobs", leading corporations focus on the roles people play in the business and the contribution they make. Specifically, leading organizations:

- Combine innovative approaches with traditional tools to identify and select key talent;
- Cast their nets broadly, relying on multiple sources such as the Internet and employee referral programs to identify key talent; and
- Help their managers identify best candidates by combining technology-based support tools with high-touch approaches to selection.

## Training and Development

Leading organizations leverage training and development programs to increase their organizational capability.

- Identify high-potential employees and continually develop them through formal and informal training; and
- Ensure the success of their talent management strategy by developing the capabilities of their managers.

## Retention

### *The Importance of Orientation*

Leading organizations use orientation programs to help new employees adjust rapidly to organization culture, structure, operating procedures, and job responsibilities. A strong orientation program allows new employees to become more productive in their jobs much more quickly than if they had not gone through a similar experience. Programs include:

- Formal orientation, which often includes guest speakers, videos and discussions about various aspects of the organization. Organization leaders may be involved in all or a portion of the formal orientation programs;
- Use extremely effective onboarding programs to reinforce the message to new employees that they've chosen the "right" organization and, equally important, to accelerate the productivity of new hires;
- Online onboarding, which may involve the use of technology to onboard new employees, often through the use of organization intranet orientation sites; and
- Assimilation programs, which may be used not only for new hires, but also for newly promoted/transferred employees to help them learn how to navigate the organization and build a strong network in their new position.

Programs may focus on the organization business model, brand messages, values and culture, organizational history, quality, ethics and confidentiality protocols.

### *Engagement*

Engagement of the workforce has become a prevalent theme in the workplace to address retention. Organizations with the best talent management practices recognize and actively build the connection between employee engagement and business results. Critical components of the employee engagement process include:

- Defining the goal;
- Creating a clear line of sight between employee actions and desired results;
- Building a high-performance culture through communication; and
- Closing the loop through rewards.

### *Rewards*

Leading organizations also use business education tools to help employees understand why goals are important, how they can help achieve them and their relationship to reward systems.

- Focus employee energies on results by basing key elements of pay on business performance and by clearly differentiating rewards for individual performance;
- Get the fundamentals of their rewards “deal” right – which is “needed to play” in the competition for top talent. This encompasses key intangibles that employees value, such as opportunities for advancement and work/life balance;
- Provide flexible reward packages that can be customized to meet varying employee expectations and help retain key workforce groups (e.g., high-potential employees, employees in “mission critical” functions, critical skills groups, etc.).

### *Work Environment Practices*

Organizations in the upstream industry identify work/life balance as a key work environment challenge. Intangibles such as work/life balance play a key role in attraction and retention. Examples of practices that provide greater flexibility and support include:

- Flexible work arrangements such as flextime, compressed workweeks and telecommuting;
- A free, confidential resource and consulting service to help employees handle personal issues;
- Childcare centres and dependent care programs;
- Time off on a paid or unpaid basis for personal development; and
- Adoption reimbursements.

Another significant challenge in the workplace is to address barriers that do not support corporate diversity goals.

- Align human resource policies and practices with diversity principles;
- Maintain significant initiatives to support and sustain a diverse workforce and an inclusive culture (communication and involvement, education and training, work/life balance, access);
- Implement measurement and accountability with respect to diversity practice; and
- Maintain ongoing communications (internal and external).



## **The Best Practices – Lessons from Industry**

This study identified a wide range of human resources best practices through stakeholders in the upstream industry. The following list is not comprehensive, but rather reflects practices that came to light through the course of the study.

### **Information, Strategy and Planning**

- Governments (HRDC and provincial/territorial governments) play a role in established and ad hoc programs that address targeted labour market issues as they arise. These programs range from established programs such as the Alberta RAP program for high school students to ad hoc programs that address an identified gap in training or skills. Ad hoc programs range in mandate, an example of which is bringing together and sponsoring industry, the labour pool and training providers to create workable solutions;
- The Athabasca Tribal Council (ATC) and the Oil Sands industry signed a “Capacity Building Agreement” designed to enhance the ability of Aboriginal Peoples in the Wood Buffalo region to participate and benefit from the development of the Oil Sands. This agreement had the following objectives:
  - To work with ATC and member Aboriginal Peoples to develop community capacity
  - To identify community and regional issues and opportunities and to resolve those issues that pertain to industrial development and opportunities
  - To work with ATC on the development of strategies to obtain Government support for addressing outstanding Aboriginal Peoples issues;
- In the Oil Sands, the Regional Issues Working Group (RIWG) provides a proactive process which promotes the sustainable development of resources within the Regional Municipality of Wood Buffalo for the benefit of all stakeholders. The Education & Jobs Committee consists of human resources practitioners from local companies and other community stakeholders to study and collaborate on the issues facing the region.

### **Labour Market Entry**

- Organizations are establishing community partnerships, both with Aboriginal and smaller communities. Companies go into the community in advance of starting operations and develop relationships with the stakeholders, learn and work within the culture, and develop sustainable long-term relationships;
- Each year, Skills/Compétences Canada (S/CC) engages students in provincial, national and international skills competitions, which showcase participants’ technical and leadership skills. Students participate in practical challenges to test skills required in the technology and trade fields. Every second year, Skills/Compétences Canada (S/CC) organizes a Canadian team, comprised of young Canadians selected from a national competition, to represent the country at the World Skills Competition;
- The Alberta Registered Apprenticeship Program (RAP) and Schools North Apprenticeship Program (SNAP) in NWT encourage future trades skills in youth by providing an early start to their career development through credit during their high school education. Students must gain employment in their selected trade and fulfill the requirements of the apprenticeship program;

- In the North, the Pipeline Operations Training Committee (POTC) is an example of a partnership between the government, industry and the local communities to prepare Aboriginals and other Northerners for long-term employment opportunities in the pipeline operations area. The POTC is in the early stages of developing a strategy to provide the selection and training of potential employees who would be employed in the operations of a Mackenzie Valley pipeline;
- The Sable Island project employed Nova Scotians early in the project's cycle, which contributed to a potential talent pool and provided the necessary lead-time to develop skills and competencies;
- In the East Coast, programs such as "Techsploration" and "Orientation to Trades and Technology" give girls and women exposure to careers in trades, technologies, science and engineering;
- The Alberta Aboriginal Apprenticeship project is a program specifically designed to provide Alberta Aboriginal Peoples with the opportunity to pursue a career in the trades. Its goal is to register a minimum of 180 Aboriginal apprentices by 2006; and
- The SAIT/BP Canada Energy Company Summer Energy Career Camp is an initiative designed to introduce Calgary's High School students to careers in the energy sector. Students participate in this career-focused learning experience and earn Career and Technology Studies credits towards their High School diplomas. Apart from experiential and fun-filled learning, the camp gives the students a chance to explore different career options in the energy sector ranging from Petroleum and Chemical Engineering Technologies to Power Engineering.

### **Attraction and Selection**

- The service sector is addressing career awareness and promotion of the industry using new technologies through a PSAC developed interactive website. The Virtual Career Fair contains videos, occupational profiles, skill/educational requirements, tools/equipment requirements and practical information as to what it would be like to work in a given occupation on a day-to-day-basis; and
- East Coast companies have developed rigorous screening processes, which incorporate the family and provide a realistic picture of what the work entails. These processes help potential candidates evaluate how they will cope with the realities of working away from home.

### **Training and Development**

- PSAC's competency-based program for designated occupations and certifications: The PSAC has developed the Petroleum Services Competency Program (PSCP) to establish industry standards for occupations in the well service sector. There are currently occupational standards for 31 field positions. Specific competencies for each position have been established and serve as the guidepost for demonstrated competence. The competencies are measured as the outcome of applying skills and knowledge on the job rather than through "pen and paper" testing;

- KeySpan Energy Canada, in partnership with a number of other companies in the oil and gas industry, has developed a competency-based education, training and development model. The system was designed to be competency-based and skill profile-oriented. Unique attributes of the system include:
  - Each employee begins the process by self-assessment of competencies – the skill inventory of the employee is portable to other companies
  - Training content is in an electronic format and is tied to the competencies to provide “just in time” availability
  - Mentors are assigned to various specialties
  - The system is designed to attract partners in content and accreditation. Consortiums have been formed in the pipeline and plant operator areas to pool content and improve industry-wide recognition and certification;
- A co-operative practice by Suncor Energy and the Communications, Energy and Paperworkers Union of Canada (CEP) whereby Suncor provided equipment and resources and the union provided the site (union office located within the city limits) to provide workers with a convenient location to take training and upgrading;
- A joint initiative with industry on the East Coast is the development of a new Master of Oil and Gas Studies degree at Memorial University. This degree was introduced in September 2003 and is a new graduate program targeted at executives already working in the oil and gas industry. The program is a professional, non-thesis, interdisciplinary degree program that will cover all aspects of the industry;
- HRDC requirements to provide a skills transfer to Canadian workers for any long-term foreign worker exemption;
- Oil Sands Safety Association (OSSA) is an industry-led group that is developing agreed-upon common safety standards and will accredit safety training programs/courses that meet those standards. If a worker comes to one of the employers and can demonstrate they have received the required accredited training, they are welcome and don't have to re-do any training in that area. The goal is to eliminate the huge amount of duplication in training that now occurs because each employer recognizes/accepts a different training course. The result can be significant savings for the companies and mobility for the workforce between sites;
- The University College of Cape Breton (UCCB) Centre of Excellence in Petroleum Development. The Centre provides resources for the establishment of infrastructure, creation of academic programs and contributions to the business community. The following multiple-use laboratories have been established:
  - Shell Canada Process Operations Lab - a pilot plant facility with equipment demonstrating plant process technology.
  - Petroleum Simulation Lab - the main learning facility for petroleum students, housing 18 workstations and one instructor teaching command centre.
  - UCCB Fluid Flow and Measurement Lab — renovations began in the first quarter of 2003 with substantial funding from Duke Energy;
- The Dexter Institute is a partnership between the Dexter Group and the Nova Scotia Community College and provides trades training and supports students who graduate from the program with guaranteed employment; and

- In the Oil Sands, Keyano College partners with local companies as an outsourced training provider. Significant industry partners include Suncor Energy Inc. and Syncrude Canada Ltd. An example of a partnership between Keyano College and the local industry was the development of the Mine Operations Co-op Program. As a result of a shortage of heavy equipment operators several years ago, Keyano and the major mine operators developed this co-op program. The program includes both formal training and paid co-op assignments with one of the three working mines. Keyano College also has programs specifically geared to the Aboriginal community. The Aboriginal Entrepreneurship Certificate Program is geared to providing training in the areas of business knowledge and skills to ensure that Aboriginal businesses are able to take advantage of the opportunities to work with the mining operators and other local companies.

## **Retention**

- Many organizations have implemented benefits programs that include personal spending accounts to encourage skills development and health. These programs provide the employee with an account and guidelines on the items that qualify for re-imbusement. Health club memberships and computer equipment are among the common uses of these accounts, but they can include fitness equipment purchases or health services that are not covered by group insurance plans;
- Retention strategies that incorporate career opportunities, learning and development and work/life balance are increasing. Specifically, some organizations offer generous flex time programs, enhanced leave provisions, education and tuition reimbursement, scholarships for family members, and targeted programs for career advancement and progression for high potential employees; and
- Oil and gas companies have implemented accommodation policies for older workers which are request driven. These programs create flexibility in the work schedule, either weekly or seasonally, where it makes sense for the business.

## APPENDIX A: STUDY METHODOLOGY

The study methodology allowed for in-depth review and analysis of all aspects of human resources in the upstream petroleum. Research was undertaken on five subjects that facilitated detailed analysis and review. These subject modules are described below.

RESEARCH MODULE	SUBJECT MATTER
<b>Module 1</b> The Evolving Economic, Business and Regulatory Environment	Assess the current and future business environment of the upstream petroleum industry; assess the economic, business and regulatory factors, trends and developments that will affect the industry, particularly as they relate to human resources, and provide a 10-year price outlook for oil and gas, an industry cash flow model and high and low case scenarios for each region.
<b>Module 2</b> The Impact of Technology	Identify, forecast and assess technology trends and developments in the upstream oil and gas industry in the context of changing human resources requirements.
<b>Module 3</b> Employment Analysis	Develop an employment profile of the upstream petroleum industry including demographics, skill requirements, employee mobility, diversity, non-traditional sources of labour, culture and human resources practices, and identify key attraction and retention issues.
<b>Module 4</b> Skill Demand and Forecast	Develop a labour demand profile for in-scope petroleum industry occupations and review labour supply to assess potential labour supply/demand imbalances for the next 10 years.
<b>Module 5</b> Training and Human Resource Development	Identify and assess the training and development activities that support the development of human resources in the upstream petroleum industry and identify best practices.

### Project Structure

To facilitate thorough research and analysis, supporting teams representing a cross-section of the industry and its stakeholders were put in place with the following mandates:

**Steering Committee:** To serve as the authority regarding the study by providing input to and decisions on recommendations put forward by the project team and the consulting team concerning the attainment of the research objectives, the content of the final report and resulting action plan.

**Sub-committees and Advisory Groups:** On behalf of the Steering Committee, provide input and direction on matters relating to that subcommittee's mandate and, where appropriate, provide decisions on recommendations put forward by the project team and the consulting team.

**Project Team:** Responsible for overseeing day-to-day management of the study project plan and research work and monitoring achievement of projected milestones.

Consulting Team: Responsible for gathering, analysis and synthesis of data and information and for developing a set of recommendations in the final report and achieving other milestones throughout the project.

Integration Sub-committee: given the mandate by the Steering Committee to:

- ensure that project methodology and processes were aligned with expected project outcomes;
- ensure that project findings were aligned with stakeholder expectations;
- ensure that potential issues were dealt with in a timely manner so that the project timeline is achieved; and
- review and approve modules on behalf of the Steering Committee.

The Steering Committee established numerous sub-committees to assist the consulting team in the research process. These sub-committees included:

- Communication;
- East Coast Regional Advisory;
- Education and Training;
- Human Resources Practices Advisory;
- North Regional Advisory;
- Occupational Groups;
- Oil Sands Regional Advisory;
- Scenarios and Industry Advisory; and
- Technology.

## **Methodology**

The study employed both qualitative and quantitative research methods. The consulting team used secondary sources where possible and undertook primary data collection where required. The request for proposal specified that the study was to be completed as discrete modules that would then be synthesized into a final report.

### **Research of Secondary Sources**

A literature review was conducted at the onset of the study. This review provided an analysis of existing data and identified the data gaps requiring primary research. These literature sources were also references during the analysis of each module. A select reference list is appended.

### **Research of Primary Sources**

Primary data was gathered from a wide range of industry representatives, human resources managers, technical specialists/experts, employees, industry association representatives, education and training providers, academic experts, the consultants, subject matter experts, government representatives and other industry stakeholder groups.

Data gathering methods included:

Focus Groups – focus groups were held in Yellowknife, Fort McMurray, St. John's, Halifax and Calgary. The following subjects were addressed:

- Education and Training Providers to the Upstream Petroleum Industry;
- Employee Experiences in Upstream Petroleum Industry;
- Employer Training and Development Practices in the Upstream Oil and Gas Industry;
- Government Regulatory, Economics and Policy impacting the Upstream Industry;
- Human Resources Issues and Practices in the Upstream Oil and Gas Industry;
- Immigrant Workers in the Upstream Petroleum Industry;
- Scenarios: Oil Sands; Industry; North and East Coast
- Drilling Technology; onshore and offshore
- Exploration Technology; onshore and offshore
- Production Technology; onshore and offshore
- Women in the Upstream Petroleum Industry.

Interviews – telephone and in-person interviews were conducted as needed.

Mail Surveys – two surveys were conducted with stakeholder groups. A headcount survey was released through the industry associations and invited approximately 1,100 companies to participate. The purpose of the headcount survey was to obtain an accurate count of key occupational categories in the WCSB using an occupational model designed to meet the needs of the industry. A human resources practice survey was released directly through the Petroleum Human Resources Council of Canada that invited approximately 100 companies to participate. Unfortunately, the low number of surveys returned, especially in the case of the headcount survey, required additional sources of data to be used. Statistics Canada's 2001 census was the principal data source for WCSB occupational information as well as national demographic and labour supply data.

The Statistics Canada census provides data not effectively collected anywhere else (i.e.: age; gender; race demographics), as well as trend analysis, yet there are inherent limitations that need to be taken into account. Numerical data are rounded, which means that not all totals are precise. Due to the lag time between data collection and availability, there may be considerable change in some of the information. We anticipate this is especially true for areas like the Oil Sands that have experienced considerable growth since the data was collected in 2001.

Proprietary Knowledge – the consulting firms that conducted this study have expertise in the industry and in human resources. The expertise and databases of both firms was drawn on extensively.

## APPENDIX B: IN-SCOPE OCCUPATIONS

An Occupational Subcommittee comprising a cross-section of industry stakeholders developed a list of occupations that would be considered “in-scope” for the study. These occupations were considered to be specific to the industry, with skills that would not be readily transferable to other industries or experiential requirements that would influence the recruitment and selection of candidates from the general pool of qualified candidates. This study focuses on occupations considered to be “core”, or central to the industry.

In distinguishing between core and non-core occupations, the Occupational Subcommittee established the following criteria for occupations that would be out of scope:

- People in occupations who would readily be able to find employment in other industries (for example, information technology and accounting);
- Those occupations that provide a service to the industry as opposed to being part of the industry (for example, the construction industry and the engineering, procurement and construction (EPC) companies);
- Those occupations that are not part of the “core business” of the upstream petroleum industry (e.g., downstream-related occupations, human resources, procurement, etc.); and
- Those occupations (or the activities done by people in those occupations) that could be outsourced to a service provider that provides the service across industries (e.g., information technology, records management, etc.). This would not include outsourcing to a service provider that only services the upstream petroleum industry.

The following list provided the baseline list of occupations for data gathering. Since some of the supply/demand analysis was based on secondary literature carried out by other researchers, there may have been some unique occupations related to the regional industry. For the WCSB region, this occupational list was mapped back to National Occupations Classifications so that Statistics Canada information could be utilized. The mapped version of this list is available through the Petroleum Council.

Aircraft Ground Handler	Data Management Coordinator - Mapping/GIS
Aircraft Technician	Data Management Coordinator - Seismic
Bed Truck Operator	Directional Drilling Coordinator
Bottom Hole Pump Repairperson	Directional Drilling Operator
Class 1 Driver	Drilling - Chief Observer
Community/Aboriginal Affairs Liaison	Drilling - Derrickman
Control Room Operator	Drilling - Drilling Supervisor/Driller
Customer Service Representative	Drilling - Field Superintendent
Data Management - Field Scout	Drilling - Floorhand
Data Management - Seismic Data Processor	Drilling - Leaseman
Data Management Coordinator - Geological	Drilling - Motorhand



Drilling - Operations Assistant	Logistics Coordinator
Drilling - Rig Manager	Maintenance - Carpenter
Economics/Financial Analyst	Maintenance - Electrician
Engineer - Chemical	Maintenance - Gauger/Measurement
Engineer - Civil	Maintenance - Instrument Technician
Engineer - Corrosion	Maintenance - Insulator
Engineer - Drilling	Maintenance - Machinist
Engineer - Electrical	Maintenance - Millwright
Engineer - Environmental	Maintenance - Pipeliner
Engineer - Facilities	Maintenance - Rotating Equipment Worker
Engineer - Geological	Maintenance - Steamfitter/Pipefitter
Engineer - Geotechnical	Marine - 1st Mate
Engineer - Instrumentation	Marine - 2nd Engineer
Engineer - Mechanical	Marine - 2nd Mate
Engineer - Mining	Marine - 3rd Engineer
Engineer - Other	Marine - Ballast Control Operator
Engineer - Petroleum	Marine - Barge Engineer
Engineer - Pipeline	Marine - Captain
Engineer - Pipeline Integrity	Marine - Communications Engineer
Engineer - Process	Marine - Diver
Engineer - Reservoir	Marine - Dynamic Positioning Technician
Engineer (Well Services, Testing, Field, Wireline)	Marine - Engine Room Operator
Environmental Advisor	Marine - Gun Mechanic
Field Engineer	Marine - Industrial and Employment Benefits Coordinator
Field Operator	Marine - Marine Engineer/Chief Engineer
Gasfitter	Marine - Naval Architect
Geologist	Marine - Offshore Crane Operator
Geophysicist	Marine - Offshore Medic
Health Coordinator	Marine - Radio Operator
Helicopter Pilot	Marine - ROV (Remote Operated Vehicle) Pilot
Journeyman Welder	Marine - Seaman
Journeyman-B Pressure Welder	Marine - Seismic Navigator
Land - Contracts Analyst (Subsurface/Mineral Rights)	Marine - Subsea Engineer
Land - Contracts Analyst (Surface)	Market Analyst
Land - Land Administrator (Subsurface/Mineral Rights)	Marketer
Land - Land Administrator (Surface)	Mechanic - Heavy Duty
Land - Negotiator (Subsurface/Mineral Rights)	Mechanic - Lead Hand
Land - Negotiator (Surface)	

Mechanic - Oilfield	Service Assistant (Coil Tubing, Cementing, Fracturing)
MWD (Measurement While Drilling) Coordinator	Service Operator (Coil Tubing, Cementing, Fracturing, Bulk Plant)
MWD (Measurement While Drilling) Specialist	Service Supervisor (Coil Tubing, Cementing, Fracturing)
Non-Steam Operator	Ships Officers
Operations - Heavy Equipment Operator	Station Operator
Operations - Process Operator	Steam Operator - 1st Class
Operators - Construction/Design	Steam Operator - 2nd Class
Operators - Control Centre	Steam Operator - 3rd Class
Operators - Drilling/Completions	Steam Operator - 4th Class
Operators - Heavy Oil	Supervisor, Field Operations
Operators - Operations Planning and Control	Supply Analyst
Operators - Pipeline Scheduling	Tank Truck and Wagon Operator
Operators - Reclamation/Construction	Technologist - Chemical
Operators - Terminal Operations	Technologist - Corrosion
Pipeline Operator & Maintenance	Technologist - Drafting/Design
Plant Superintendent	Technologist - Electrical
Production Accountant	Technologist - Engineering
Project Manager	Technologist - Engineering (Mechanical)
Quality Assurance Analyst	Technologist - Engineering (Petroleum)
Quality Assurance Manager	Technologist - Geology
Regulatory Analyst	Technologist - Geophysics
Safety	Technologist - Geotechnical
Safety/Environment	Technologist - Instrumentation
Seismic Acquisition - Crew Manager	Technologist - Lab
Seismic Acquisition - Field Supervisor	Technologist - Mining
Seismic Acquisition - Heavy Equipment Operator	Technologist - Other
Seismic Acquisition - Seismic Driller	Technologist - Process
Seismic Acquisition - Seismic Permitting Coordinator	Warehouse Technician
Seismic Acquisition - Seismic Project Manager	Well Servicing - Derrickhand
Seismic Acquisition - Seismic Shooter	Well Servicing - Driller (Operator)
Seismic Acquisition - Survey Worker	Well Servicing - Drilling Supervisor
Seismic Acquisition - Surveyor	Well Servicing - Floorhand
Seismic Observer	Well Servicing - Motorhand
Seismic Processor	Well Servicing - Rig Manager (Tool Push)
Seismic Worker	Well Servicing - Swabtech Operator
	Wellsite Geologist
	Winch Tractor Operator
	Wireline Specialist

## APPENDIX C: MODULE SUMMARIES

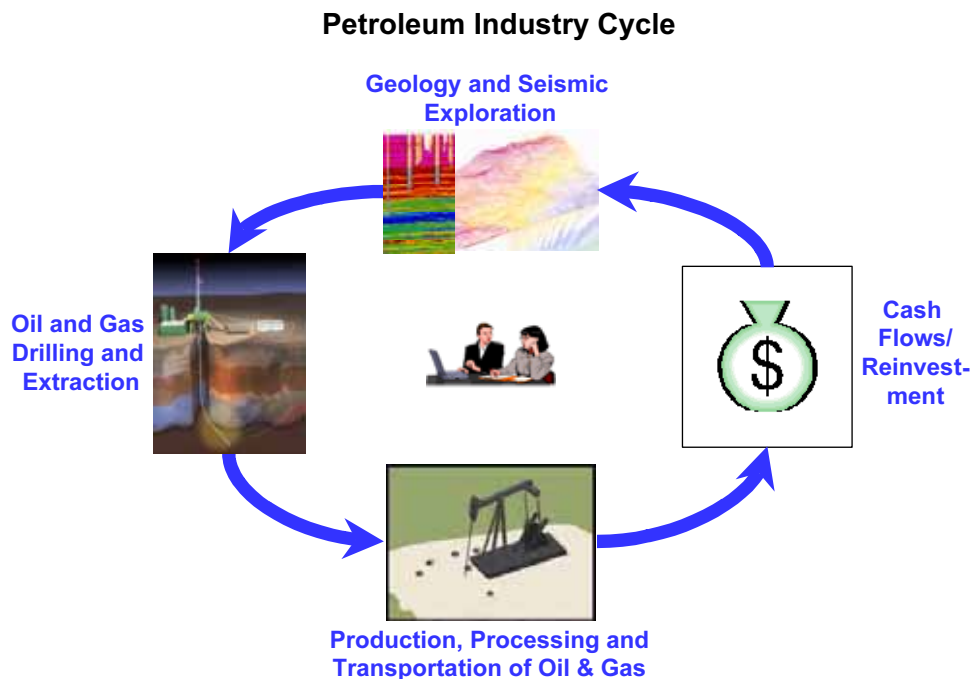
This section summarizes the research findings of the five research modules.

### Module 1 Overview: The Evolving Economic, Business & Regulatory Environment

#### Definition of the Upstream Petroleum Industry

The upstream petroleum industry typically refers to people and companies that harvest the oil and gas resources through exploration, drilling, producing oil and gas, and mining Oil Sands. This study also reviews midstream processors, and oil and gas transmission pipelines.

This figure illustrates the petroleum industry cycle. Existing production generates cash flow, which is largely reinvested in exploration and drilling to replace produced reserves, and to generate new production.



## **Canada's Place in the North American and Global Oil and Gas Industry**

As petroleum is the world's most traded commodity, the Canadian oil and natural gas industry is exposed to market conditions on both a global (oil) and continental (gas and oil) basis. For the last two decades, Canadian oil producers have received world prices for oil. In contrast, Canadian natural gas is integrally linked to the North American market and has associated pricing.

Canada holds more than 4.6 billion barrels of conventional oil reserves (2002), or 0.5 per cent of world oil reserves. Canada produces 2.9 MMBbl/d (2002), some four per cent of the 73.8 MMBbl/d conventional world oil production. The Alberta Oil Sands hold six billion barrels of unconventional bitumen reserves considered to be economically recoverable with today's technology and oil prices, with tremendous potential for expansion via technology. Canada's East Coast and North are largely unexplored increases or growth regions.

Canada holds 60 trillion cubic feet (Tcf) of gas reserves, 1.1 per cent of the global reserves, and produced 6.5 Tcf (17.8 Bcf/d) in 2002. Canada is the world's second largest exporter of natural gas. Gas is exported exclusively to the United States. In 2002, Canada exported 3.8 Tcf of gas, 58 per cent of Canada's gas production.

## **Oil and Gas is a Significant Part of the Canadian Economy**

Most of Canada's oil and gas is produced in the Western Canada Sedimentary Basin (WCSB), largely in the western provinces of Alberta, British Columbia, and Saskatchewan. Nearly half of Alberta's oil is non-conventional and, combined with Newfoundland's oil production, more than half of Canadian oil production is non-conventional and offshore (vs. 22 per cent in 1991). The East Coast currently supplies eight per cent of total Barrels of Oil Equivalent (BOE) production, which will increase through this decade. Canada's gas reserves in the Mackenzie Delta region are expected to be commercialized late in this decade.

Canadian conventional oil reserves have declined by 14 per cent since 1991, while gas reserves have declined by 37 per cent. Finding, production and operating costs in the WCSB have increased as the basin matures. Returns on capital employed have averaged about four per cent, under-performing other industries. Therefore, levels of investment in the conventional WCSB are declining and production is not fully being replaced by new reserves.

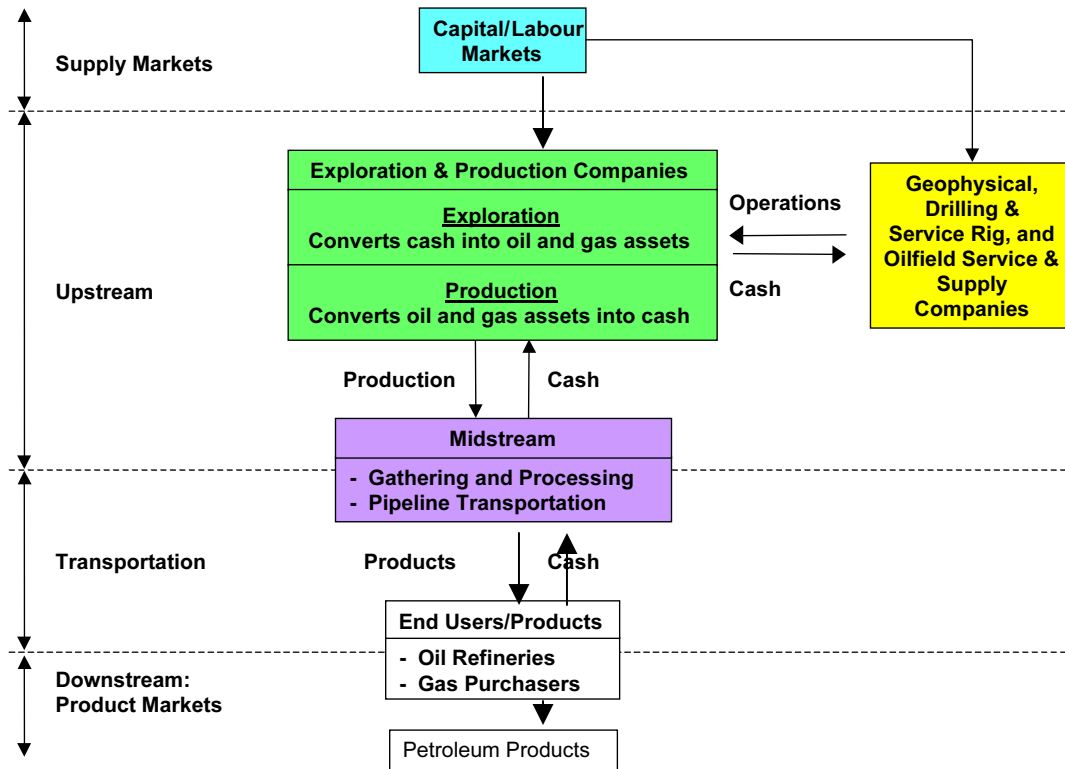
To counterbalance declining profit margins, the industry has been rationalizing and restructuring since the 1986 oil price crash. This has been especially noticeable during the last five years. One effect is reduced exploration and development because available capital is being used to buy existing reserves rather than to find new reserves. The rise of royalty trusts has contributed further to the reduction of exploration and development because trusts are primarily harvesters and producers of the resource. This stems from their emphasis on maximizing cash returns to shareholders; therefore, they minimize risks and costs by producing the resource while undertaking only low-risk drilling activity.

The oil and gas industry offers considerable potential, especially in the three frontier and new production areas and in deep gas, tight gas, and coal bed methane in the WCSB. The Canadian oil and gas industry offers attractive, diverse and secure potential.

## Structure of the Industry

Many different kinds of companies find, produce and sell oil and gas. The conceptual model below illustrates this structure.

### The Upstream Petroleum Industry



## Total Employment in the Industry

The number of exploration and production firms in the upstream industry is approximately 700 – 1,000, including explorers, majors, intermediates, juniors and small operations. Statistics Canada reports that 475 of these firms account for 95 per cent of all domestic production.

Statistics Canada 2001 Census estimates the direct employment in the upstream petroleum industry at 120,040 jobs. The Canadian Association of Petroleum Producers (CAPP) estimates that the total employment impact from the industry in Canada is more than 500,000 jobs.

The very large exploration and production companies typically employ between 500 and 3000 people, while the large oil and gas pipeline companies employ between 1,000 – 2400 people. The levels of employment, particularly in the drilling/service sectors, vary with the level of field activity. However, as the chart below indicates, these sectors make up the majority of the employment in the upstream industry.

Organized labour, mainly the Communications, Energy and Paperworkers Union of Canada (CEP), plays a role in areas such as the Oil Sands, British Columbia and Alberta gas plant operations, Norman Wells in the NWT, and East Coast projects such as Hibernia and Terra Nova. There are approximately 3,200 unionized employees directly employed in the upstream sector.

<b>EMPLOYMENT IN THE UPSTREAM PETROLEUM INDUSTRY</b>					
<b>Region</b>	<b>Oil &amp; Gas Extraction</b>	<b>Activities Supporting Extraction</b>	<b>Crude Oil Pipeline</b>	<b>Natural Gas Pipeline</b>	<b>Total</b>
Canada	49,800	65,165	2,415	2,660	120,040
WCSB	39,575	54,080	1,725	2,115	97,495
Oil Sands	6,620	905	n/a	n/a	7,525
North	150	440	20	n/a	610
East Coast	1,550	2,295	40	25	3,910
Central Canada	1,245	5,960*	550	400	8,155
Other	660	1,485	80	120	2,345
*For Central Canada, this number also includes mining occupations. Due to the nature of the occupational codes used by Statistics Canada, this employment figure could not be further differentiated to reflect only upstream petroleum industry.					
Source: Statistics Canada 2001 Census.					

The E&P companies are supported by a significant service sector that provides equipment, products, and technical expertise, including the following groups of companies: geophysical, drilling and service rig and oilfield supply and service.

Conventional oil and gas wellhead production is collected through smaller diameter field gathering pipelines and transported to midstream processors (to process and purify the oil or gas) prior to shipping to markets via long-haul, larger diameter pipelines. Midstream processors may also provide additional services such as pressure boosting, temporary storage, and marketing. While the growth in mid-stream companies is an important recent trend, these companies still represent a modest proportion of the upstream processing business.

Offshore oil is shipped from offshore facilities, while gas is gathered at a central platform for conditioning before being moved by pipeline to onshore gas processing facilities. Pipelines providing service in the frontier/growth regions are important for commercialization as the infrastructure is much less developed than in the WCSB.

### **The Changing Business Environment of the Industry**

The upstream oil and gas industry continues to be shaped by three major trends:

- Globalization — with five mergers of very large companies in the last four years to create world “mega-Majors”. Most of the traditional “majors” have shifted new activity from the conventional WCSB to the frontier and new production regions, which offer both larger scale developments, and the best opportunity to employ their leading-edge technology to competitive advantage;

- North American “continentalization” has been driven by the freer trade in gas and power, and the advantages of efficient exploitation of mature assets. This trend is now largely played out as most large US independents have added Canadian gas to their lower 48 gas portfolio. In the last four years, international energy companies, mainly American, have spent about \$30 billion US to acquire many Canadian E&P companies; and
- Royalty trusts have grown very rapidly, largely at the expense of medium-sized E&P companies, and use a model characterized by efficient exploitation and development, with a minimum of exploration and risk. Assets held by royalty trusts now exceed \$13 billion. With strong commodity prices and low interest rates, the business model is so compelling that traditional oil and gas companies are hard pressed to compete for assets and a number are selling out or converting their assets into trusts. When producing assets are acquired by a trust, there will be less future exploration than by a traditional E&P company. The royalty trust presence in the WCSB is expected to continue expanding in the future due to the increasing maturity of the conventional basin.

Due to these three trends and the strong returns expected by investors, western Canada now has few medium-sized active explorers who, in the past, often spent a multiple of their cash flow and drove considerable drilling activity. A common business model in the last few years is for junior companies and the few remaining medium-sized companies to acquire assets and then sell out to the royalty trusts. In an environment where commodity prices are favourable, new startups will resurface and initiate new exploration programs.

In 2002, the top 15 Canadian companies produced nearly 3.7 million barrels (or 3,700 thousand BOE/D of oil equivalent per day (MBOE/d)). This is more than a 120 per cent increase from the top 15 in 1992 (1,630 MBOE/d). Also, eight of the players are new corporate entities and the number of Canadian head offices has dwindled, reflecting the continentalization trend.

<b>TOP 15 CANADIAN EXPLORATION AND PRODUCTION COMPANIES</b>			
<b>Rank</b>	<b>1992 Companies</b>	<b>2001 Companies</b>	<b>Change</b>
1	Imperial Oil	EnCana Corp.	New, M&A
2	Amoco Canada	Imperial Oil	
3	Petro-Canada	Canadian Natural Resources	New, M&A
4	PanCanadian Petroleum	Husky Energy	M&A
5	Shell Canada	Devon Energy	New, M&A
6	Gulf Canada Resources	ExxonMobil Canada	M&A
7	Mobil Oil Canada	Burlington Resources Canada	New, M&A
8	Chevron Canada Resources	Talisman Energy	New, M&A
9	Suncor	Petro-Canada	
10	Husky Oil	BP Canada Energy Co.	New (Prior Amoco)
11	Norcen Energy Resources	Shell Canada	
12	Saskatchewan Oil & Gas Corp.	Suncor	
13	AEC Oil and Gas	Anadarko Canada	New, M&A
14	Home Oil Company	ConocoPhillips Canada*	New, M&A
15	Encor	Chevron Canada Resources	
* reflects merger completed in 2002			

<b>SIGNIFICANT MERGERS AND ACQUISITIONS IN CANADA (1998-2002)</b>					
<b>2002</b>		<b>2001</b>		<b>2000</b>	
<b>Was</b>	<b>New</b>	<b>Was</b>	<b>New</b>	<b>Was</b>	<b>New</b>
Ketch	Acclaim	Anderson	Devon	Beau Canada	Murphy
AEC, PanCanadian	EnCana	Berkley	Anadarko	Cabre	EnerMark
Elk Point	Acclaim	BXL	Viking	Crestar	Gulf Canada
Pipeline Merger		Canadian Hunter	Burlington	Edge	Ventus
<b>Was</b>	<b>New</b>	Chieftain	Hunt Oil	Fletcher Challenge	Apache
West Coast	Duke	Cypress	PrimeWest	Newport	Hunt Oil
		Encal	Calpine	Pursuit	EnerMark
		Enermark	Enerplus	Ranger	CNRL
		Founders	Provident	Renaissance	Husky
		Gulf Canada	Conoco	Renata	Rio Alto
		Magin	NCE	Ulster	Anderson
		Maxx	Provident	UPR	Anadarko
		Numac	Anderson	Unocal	Northrock
		OGY	Baytex		
		Petromet	Talisman		
		Post	Ketch		
		Rio Alto	CNRL		
		Search	Advantage		
		Triumph	Baytex		
		Velvet	El Paso		
		Ventus	Petrobank		

<b>1999</b>		<b>1998</b>	
<b>Was</b>	<b>New</b>	<b>Was</b>	<b>New</b>
Big Bear	Avid	Amber	AEC
Gardiner	Cypress	Archer	Dominion
Highridge	Talisman	Barrington	Sunoma
Inuvialuit	Ventus	Blue Range	Big Bear
Poco	Burlington	Chauvco	Pioneer
Rigel	Talisman	CS	PanCanadian
Wintershall	Startech	Mobil	ExxonMobil
		Norcen	UPR
		Northstar	Devon
		PanEast	Poco
		Paragon	Northrock
		Pinnacle	Renaissance
		Remington	Dominion
		Tarragon	Marathon
		Torrington	Magin
		<b>1998 Pipeline Merger</b>	
		<b>Was</b>	<b>New</b>
		NOVA	TransCanada

Source: Ziff Energy Group



One consequence of merger and acquisition (M&A) activity has been the decrease in drilling activity by the combined entity (typically a 20 to 40 per cent decrease) largely due to the need for greater scale in prospect size. This reduced level of drilling is partially due to the merged companies having a greater selection of prospects to invest in, particularly internationally, and therefore the ability to 'high-grade' these opportunities.

With the increasing corporate demand for scale, there has been a migration of new investment dollars from the WCSB to the three less mature, potentially high growth regions of Canada, as well as internationally. These growth regions include: the Oil Sands, the East Coast and the North.

While there is a trend for decreased drilling activity by larger, merged companies, industry drilling activity as a whole has continued to increase over time. This is attributed to high commodity prices creating an environment for increased drilling by junior and medium-sized companies. Future drilling activity is projected to gradually decline under both the low and high case scenarios defined by the study; however, these levels will still be more than double the drilling activity of the 1990s.

### **Overview of Regulatory, Government and Policy Issues**

The Canadian constitution and various international agreements set the context for the Canadian energy regulatory framework. Government sets energy policy, and legislative regulations govern industry actions. The National Energy Board (NEB) is the key federal regulator for the industry. Provincial and territorial governments, as well as Offshore Boards on the East Coast, oversee industry regulation.

The regulatory frameworks and processes that most affect human resources are those focusing on environment and safety, regional/local socio-economic benefits, and consultation with stakeholders. Regulations related to environment and safety ensure industry is operating in a safe and environmentally sound way. Employers must make sure their workforce can operate facilities safely. This means all employees must receive mandatory safety training. In some cases, as with Onshore Pipeline Regulations, employers must have competency-based training programs in place.

The need to comply with regulations governing environmental protection, environmental risk assessment and emergency response implies skill sets that companies must employ or engage under contract. These environmental, safety and proof of competency obligations can be a significant burden to companies – especially smaller companies. As a result, there has been an in industry collaboration to address these issues.

On the East Coast, Benefit Plans are required by the Canada –Newfoundland Atlantic Accord and Canada-Nova Scotia Offshore Petroleum Resources Accord and are subject to approval prior to the issuing of any Work Authorization by the Offshore Boards for exploration or development and production activities. Benefit Plans relate to how an industry company will ensure full and fair opportunity and first consideration given in procurement; employment and/or training; research and development to residents of the province they are operating in. First consideration indicates that if all things are equal – qualifications; competitive goods and services; fair market price etc. – a provincial resident or company will get the job/contract. There may be a further requirement to provide a plan outlining the involvement of disadvantaged individuals or groups in

training and employment opportunities or participate in the supply of goods and services. In many instances, these plans take the form of diversity plans specifically identifying opportunity for involvement of women; immigrants; disabled persons and Aboriginal Peoples. The intent of this legislation is to provide the greatest opportunity for the development of local capacity and long-term benefits. Ongoing monitoring and reporting is required to ensure obligations are being met.

The regulatory process requires inclusive public consultation. These consultations can be time and cost intensive, but the failure to adequately perform the required consultation can put proposed industry activities at risk. This requirement has seen an increased importance within companies to have people who are skilled and knowledgeable on consultation, issues resolution, public affairs and stakeholder relationship building. Also, because of the need for industry to access lands that are under aboriginal control, there is a much greater focus on the development of relationships between industry and Aboriginal Peoples and communities that are long-term and mutually beneficial. These relationships are often built on focusing on ways in which the Aboriginal Peoples can have long-term involvement in the industry through education and training, employment and business opportunities.

### **Regulatory Impact on Human Resources**

- Regulations can affect HR practices by placing a strong emphasis on developing local skills in both developed and frontier and new production regions. In some cases, long lead times are required in order for workers to acquire needed competency levels;
- Increased sensitivity to environmental issues affects the skill sets required by workers in the industry both specifically (e.g. demand for more environmental technicians) and generally (awareness of environmental regulations and guidelines). In a very broad sense, the impact of environmental initiatives (such as the Kyoto Accord) may influence the level of investment in the Oil Sands or add to the complexity of East Coast Offshore environmental regulations. Such effects directly influence employment levels;
- Aboriginal Peoples issues, such as land claims and local involvement in northern development, will influence the hiring programs of companies working in more remote regions. Ultimately, the educational infrastructure must evolve to meet the needs of both Aboriginal Peoples as well as the changing requirements of the industry;
- The safety and health of both workers and those who live near sources of petroleum production and processing will continue to be a high priority. Legislation is driving training and development, and in the Oil Sands companies are collaborating to establish safety standards. Safety training, demonstrated competence and accreditation will become more standardized within the industry and act as a prerequisite for employment for both employees and contractors;
- Fiscal systems and economic development programs do not directly affect human resources but have an indirect effect on overall employment levels. Similarly, payroll taxes such as the Canada Pension Plan and Employment Insurance have an indirect impact on employment levels, especially for less skilled employees;

- Provincial/territorial tax regimes can be a deterrent to interprovincial/ interterritorial mobility as it has a direct impact on cost of living in any given province or territory.
- Immigration policies directly affect the ability of industry to draw on labour sources from outside the country. Similarly, governments and professional associations control the processes of professional and vocational accreditation. These processes directly affect both the overall labour pool availability, as well as the quality of the labour pool; and
- East Coast offshore benefits plans affect issues of “first consideration” and “full and fair opportunity”, and investment by companies in research and development, training and development, and employment of skilled labour.

Each of these issues has an effect on the level of upstream investment and on the level of development in particular regions. Fiscal regimes are also critical for the pace of industry economic development, particularly in the less developed frontier and new production regions.

Key issues for the regions include:

#### WCSB

- The regulatory process is well developed – safety and the environment are key areas of focus;

#### Oil Sands

- The environment and safety are the key policy issues.

#### The North

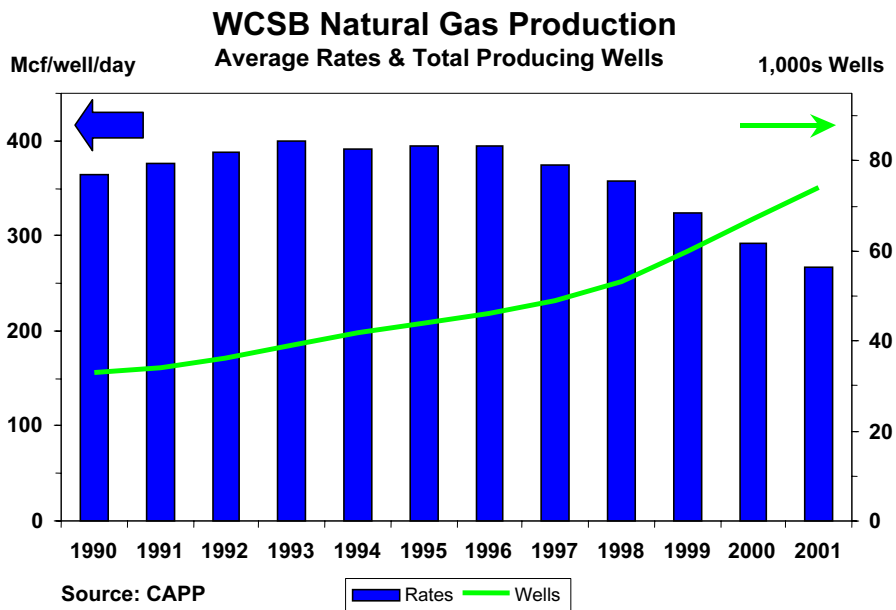
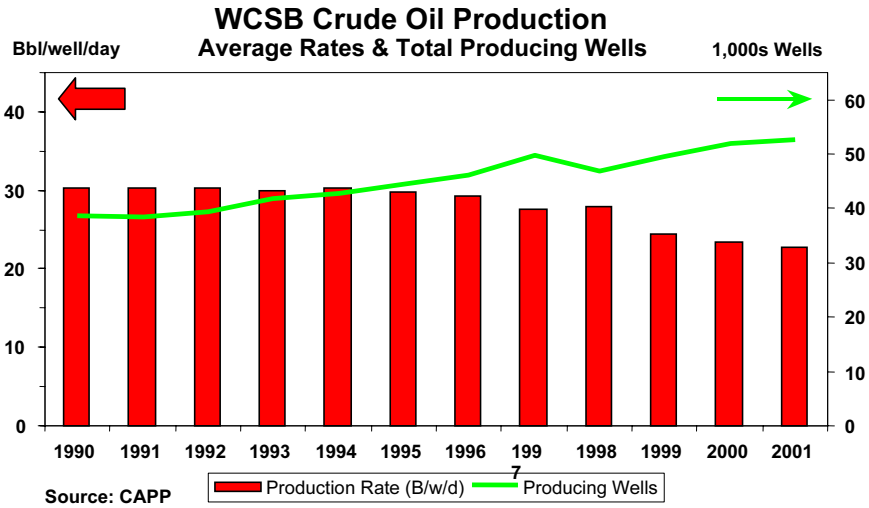
- A streamlined regulatory process for a Mackenzie Valley gas pipeline project is critical. Without that, development of the region cannot proceed.
- Involvement of Aboriginal Peoples is another critical success factor for Northern development.

#### East Coast

- The regulatory framework is complex and burdensome, with overlapping jurisdictions. Streamlining of the process, which is underway, will facilitate further development in the region.

### **Western Canada Sedimentary Basin Maturing**

During the last five years, the industry replaced only 89 per cent of its conventional oil production and 74 per cent of its gas production through discoveries, extensions and improved recovery. Further evidence of maturation is the significant increase in finding and development costs. Production of conventional oil in WCSB declined by 13 per cent between 1995 and 2001 to about 1.2 MM Bbl/d. The following figures show the increasing maturity of the conventional WCSB, declining oil and gas resources per new well since the mid-1990s, and producing wells required to maintain daily total production.



## WCSB Scenarios

The following scenarios were developed in February of 2003 by a broadly representative advisory committee.

The scenarios are not forecasts; rather, they identify upper and lower price outlooks averaged over a 10-year time frame that lead to different levels of activity and therefore different human resources needs. Short-term price fluctuations will occur throughout this 10-year period and have been averaged within the upper and lower price ranges.

The Upper Oil Price Outlook assumes robust energy demand globally, based on strong economic recovery commencing in 2004. OPEC continues to manage oil supply, and

new oil supplies from the former Soviet Union (FSU) and west Africa are easily absorbed.

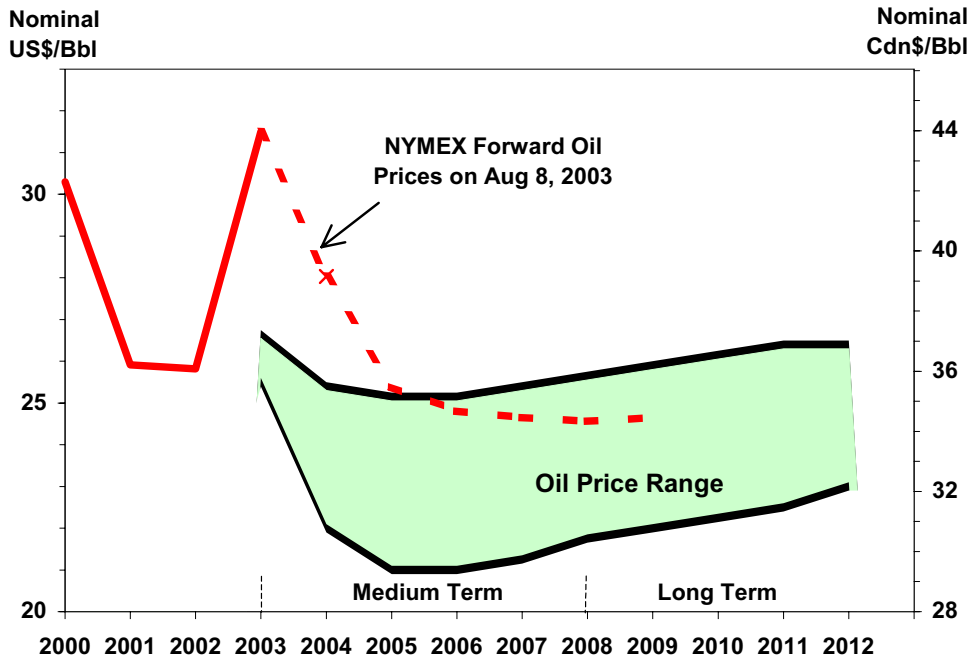
This is partly due to lower production from traditional areas such as conventional North America and from South America where political change and unrest inhibits activity. In some countries, the Kyoto Accord has slowed energy development as well.

The Lower Price Oil Outlook assumes that in the wake of the Iraq war the global economy is uncertain, economic recovery slower, and energy demand more modest. Oil production increases significantly from Iraq, and Venezuelan oil production recovers quickly.

Kyoto and climate change are adopted slowly (or technology advances) and the impact on new energy supplies (including Canadian Oil Sands) is only modest. OPEC strains to maintain oil price control.

The high and low case oil price outlook to 2012 is shown on the following chart.

### Oil Price Outlook



US\$/Bbl	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
High	26.75	25.50	25.25	25.25	25.50	25.75	26.00	26.25	26.50	26.50
Low	25.75	22.25	21.25	21.25	21.50	22.00	22.25	22.50	22.75	23.25

Exchange Rate assumed is US\$0.72=Cdn\$1  
 Note: NYMEX Price line is the Spot Market Price

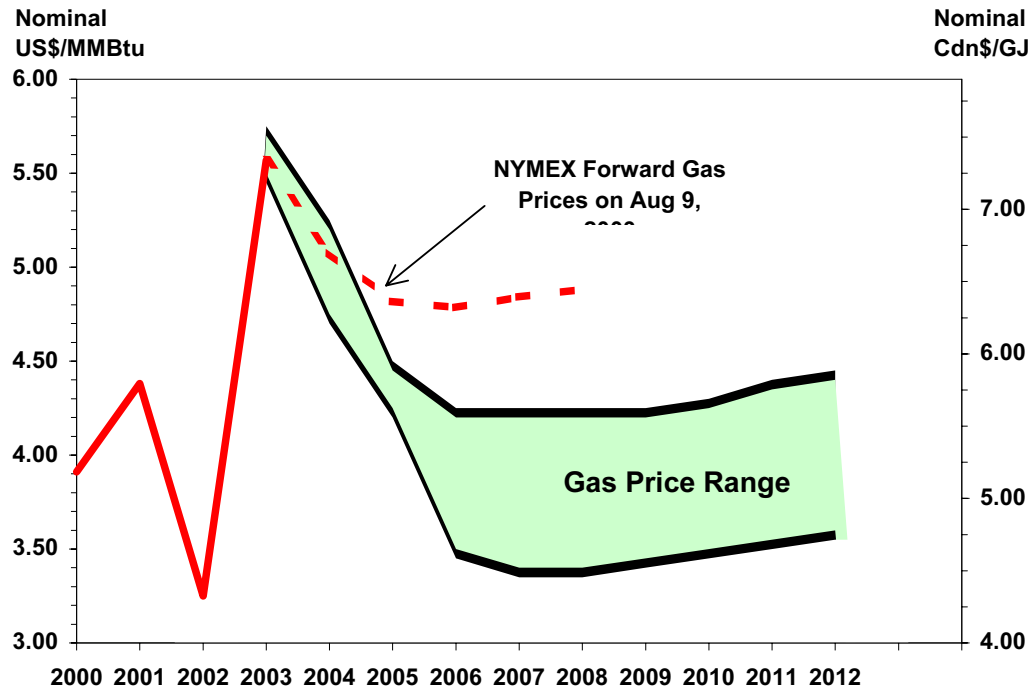
The Upper Gas Price Outlook assumes the economy and overall gas demand are strong and increased power demand more than offsets the decrease in process gas use. North American gas supply remains strained due to the advanced maturity and steady decline of the conventional supply regions.

New gas drilling continues to yield lower reserve additions. Expansion of North American Liquefied Natural Gas (LNG) facilities is limited as adjacent landowners oppose expansion or new facility development. Kyoto and climate change policies are enforced, constraining alternate fuel competition.

The Lower Gas Price Outlook assumes that US economic recovery is slower and energy demand is more modest. Due to improved technology, the yields of new gas drilling (e.g., west of the fifth meridian in Canada, Deep Shelf in the US) are strong, and new onshore gas sources such as coal bed methane and tight gas develop more rapidly with good results. Traditional area declines 'flatten out'. The US Energy Bill contains incentives for domestic gas, opens restricted lands, and encourages rapid development of LNG to offset reliance on OPEC oil. Climate change policy does not arrive in the US, or compliance is voluntary.

The figure below shows the high and low gas price outlook to 2012.

### Gas Price Outlook



US\$/M MBtu	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
High	5.75	5.25	4.50	4.25	4.25	4.25	4.25	4.30	4.40	4.45
Low	5.50	4.75	4.25	3.50	3.40	3.40	3.45	3.50	3.55	3.60

Exchange Rate assumed is US\$0.72=Cdn\$1  
 Note: NYMEX Price line is the Spot Market Price

### Industry Cash Flow Model

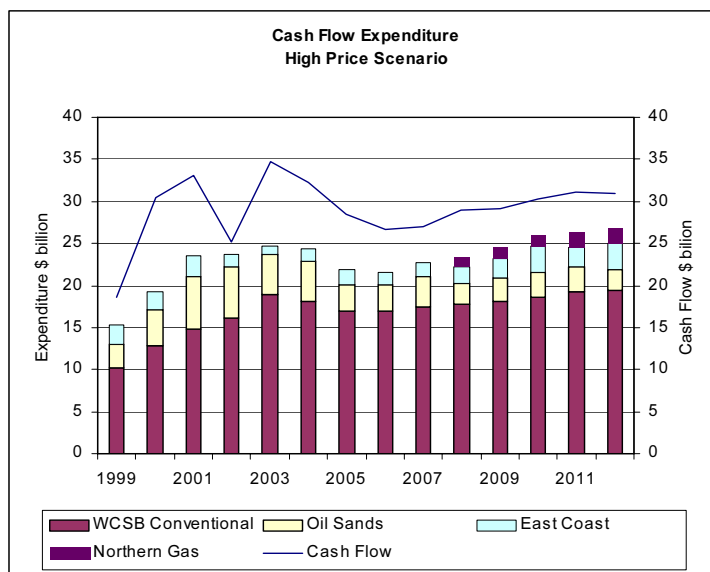
This is an interactive, upstream oil and gas industry cash flow model that employs annual capital expenditure as an input value that affects the cash flow generated by activity resulting from the assumed reinvestment rate. The cash flow model has been adapted and extended in time from the industry model developed by First Energy Capital Corporation, a leading Canadian investment firm.

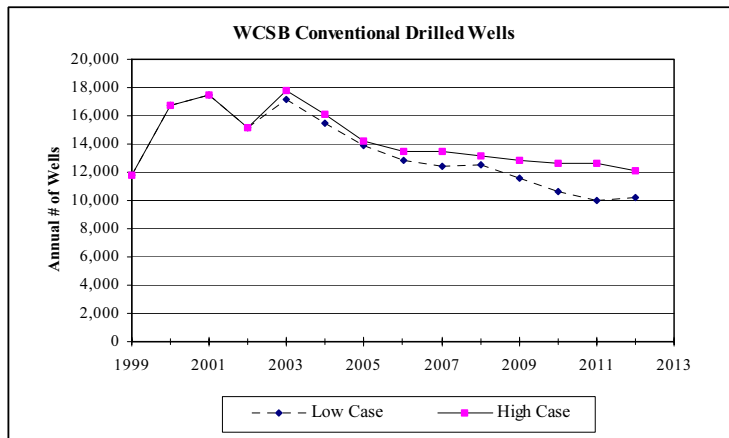
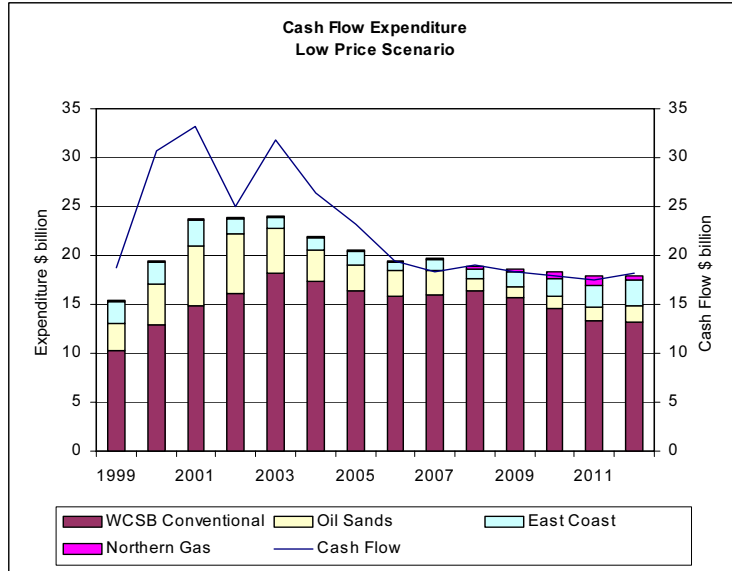
We applied the high and low price scenarios to the industry cash flow model to project oil and gas wells drilled, capital and operating expenditures in western Canadian conventional operations, and associated oil and gas production — the factors which will drive the demand for human resources in conventional oil and gas in the WCSB. The industry cash flow was calculated and then an estimated capital expenditure used that generated a reasonable reinvestment rate in western Canada for each case.

In the high case scenario, total industry capital expenditures are estimated to be \$238 billion over the 10-year period. Conventional WCSB oil production will drop by a quarter to 925,000 Bbl/d, and gas production increases by two per cent to 16 Bcf/d by 2012 (largely due to unconventional gas). A total of 138,500 wells are drilled in the WCSB for the 10-year period. Total Canadian oil production (including crude oil, natural gas and liquids, synthetic from Oil Sands, East Coast and the North) will increase steadily from 5.3 million BOE/d in 2002 to 6.2 million BOE/d in 2007 and to 6.9 million BOE/d in 2012.

In the low case scenario, total industry capital expenditures are estimated to be \$197 billion during the 10-year period. Conventional WCSB oil production will drop by about a third, and gas production decreases 9 per cent to 14 Bcf/d by 2012. A total of 127,000 wells are drilled in the WCSB during the decade. Overall Canadian production (as defined in High Case above) will increase only slightly from 5.3 million BOE/d in 2002 to 5.4 million BOE/d in 2007 and 5.5 million BOE/d in 2012.

### Cash Flow vs. Capital Expenditures





## Regional Economic Scenarios

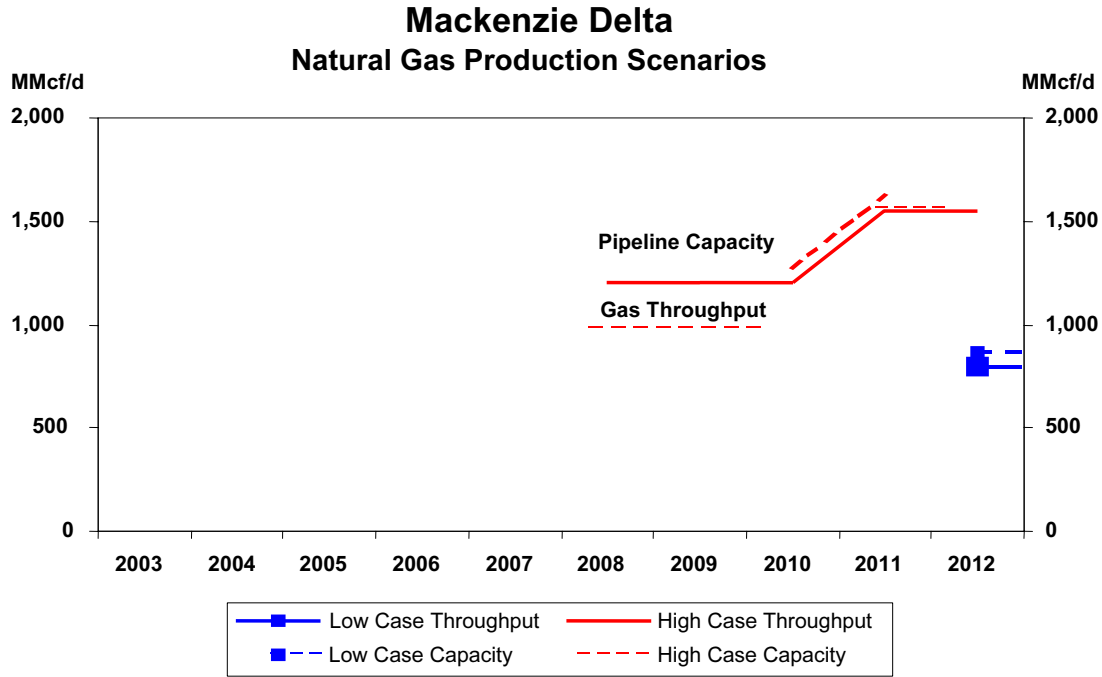
### North Scenarios

The proven gas reserves are held by members of the Delta Producer Group (Imperial Oil Limited, ConocoPhillips, Shell Canada Limited, and ExxonMobil) and are primarily the result of exploration activity 20 to 25 years ago. The Delta Explorer Group (Anadarko, BP, Chevron, Devon, EnCana, Petro-Canada and Burlington) does not have any significant proven reserves to date, but have or plan active exploration programs. Development of these reserves will require the construction of large gathering and processing facilities in the Mackenzie Delta for shipment south on the pipeline.



Standard Mackenzie Valley Pipeline

The Delta Producers have formed a project team led by Imperial Oil. They filed a preliminary information package with the National Energy Board (NEB) on June 18, 2003 and plan a formal NEB filing by late 2003. Several pipeline designs are under consideration.



Under the high case scenario, a higher capacity pipeline is placed in service by mid-2008; all planning and construction phases occur without any delays. Outstanding land claims are settled expeditiously, the regulatory process is streamlined and the responsible agencies co-operate to approve the application for the pipeline in early 2006 (24 months from filing).

Material and equipment are barged in and staging areas and camps are established during the summer of 2006. Construction proceeds without difficulty during the winters of 2006/2007 and 2007/2008, and the pipeline is put in service by late 2008.

Under the low case scenario, the in-service date for the pipeline is significantly delayed and a smaller pipeline is constructed. Numerous influences have a negative impact, such as Canada’s ratification of the Kyoto Accord, the Delta Explorer Group experiencing disappointing results, limited additional reserves are proven, land claim settlements prove elusive and the regulatory process is protracted.

**East Coast Scenarios**

The offshore of Newfoundland and Labrador is oil-prone (with some potential gas development). Offshore Nova Scotia appears to be a strong gas play (with some potential liquids). The deep water (slope) is thought to contain both gas and oil.

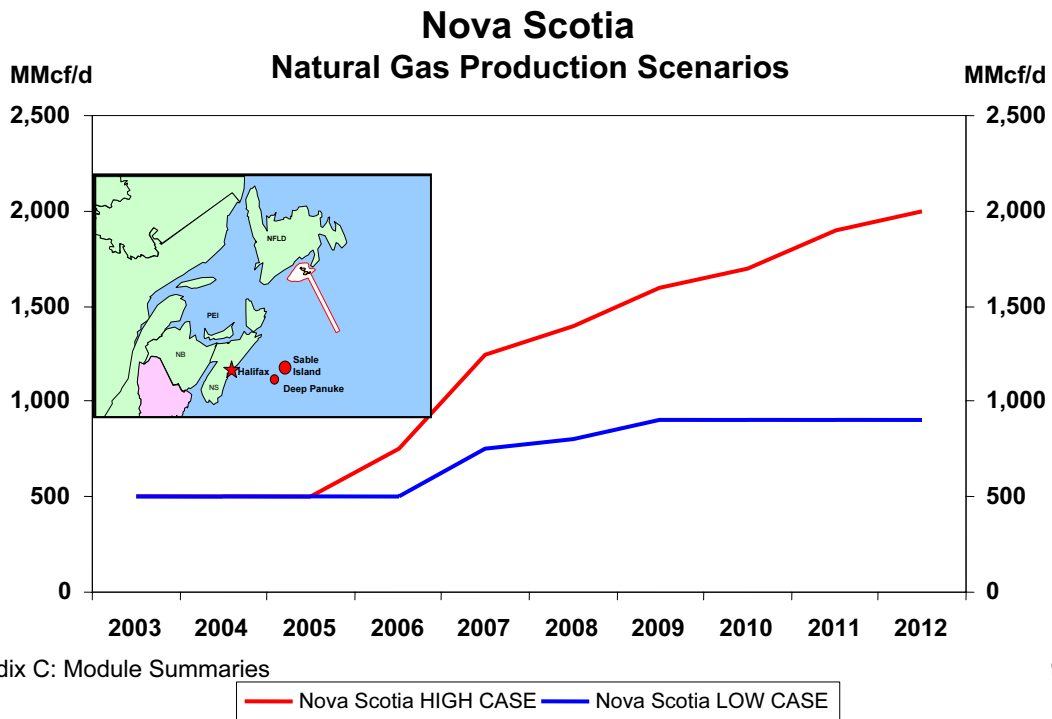
Given the immaturity of the exploration and development of the East Coast, coupled with a longer than expected and more complex regulatory (environmental and facility) oversight, the major potential developments for the East Coast will occur in the later part of the next five years and into the six- to 10-year, or long-term, timeframe. The main influence on offshore development will be the ability of industry to achieve and sustain attractive exploration success rates and hydrocarbon resource additions during the next decade. Success will encourage consistent capital spending in exploration and the appraisal and development of future discoveries. It may also assist to address some of the skepticism about the industry that has resulted from the “start and stop” history it has had on the East Coast.

The scenarios must be examined in the context of government and regulatory factors that will influence future east coast activity. The joint federal provincial management regimes resulting from competing claims to jurisdiction add a degree of complexity not found in onshore regions. Coupled with this are multi-jurisdictional regulatory processes, particularly with respect to offshore pipelines and gas plants in the case of Nova Scotia. Further regulatory oversight arising from “laws of general application” at both the activity approval and operating stages contribute to the regulatory complexity experienced by companies active on the east coast.

Concerns regarding the impact of the regulatory regime on costs and activity are currently the subject of a joint government industry initiative (the Atlantic Energy Roundtable) with the objectives of streamlining the system and enhancing competitiveness. One outcome is expected to be greater regulatory consistency between Nova Scotia and Newfoundland and potentially increased cooperation that could help stimulate development from a regional East Coast perspective, rather than solely provincial perspectives. This could act as a catalyst for the development of a regional offshore natural gas pipeline system to enable Newfoundland and Labrador gas to reach markets, and encourage the interconnection of marginal or new fields.

**Nova Scotia Scenarios**

This figure shows the high and low case natural gas production scenarios for offshore Nova Scotia.



Under the high case scenario, the Maritimes and North East Pipeline (M&NP) expansion of 400+ MMcf/d is implemented for 2006 (delayed by at least one year), expanding the system via new compressor development. Exploration activity is encouraged by the Deep Panuke development and drilling successes by other producers.

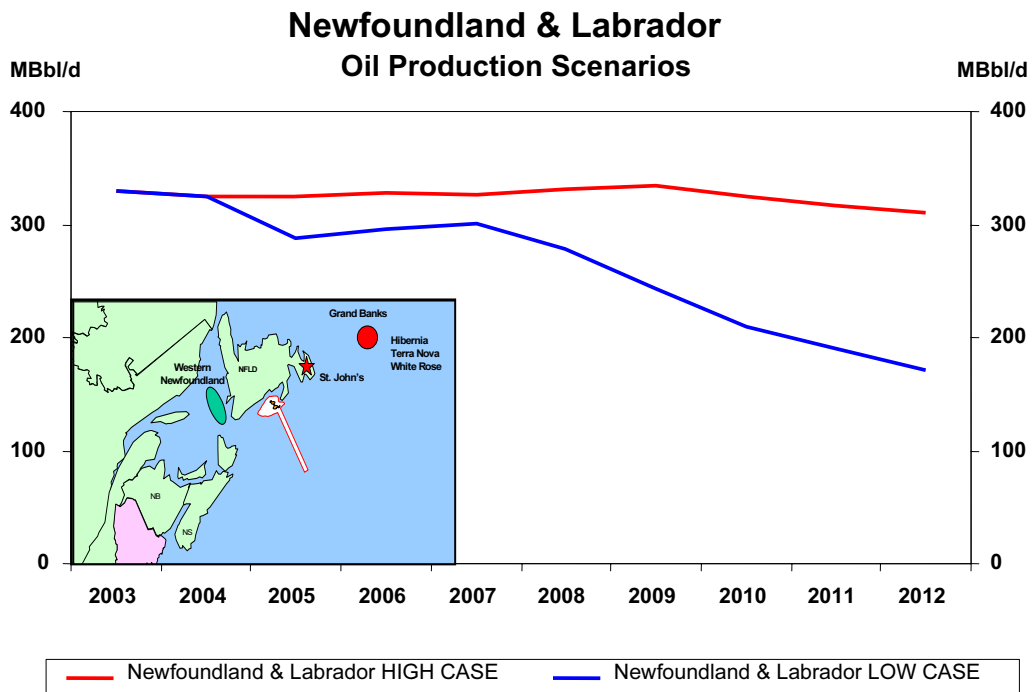
In the longer term, an offshore gas pipeline connects to mainline Nova Scotia and expands existing facilities or is developed sub-sea to the US Northeast. Several proposals are being examined; all consider how to maximize the potential development of offshore gas. A new regional pipeline concept may replace the “point-to-point”, single project gas pipelines.

Under the low case scenario, the M&NP expansion of 400 MMcf/d+ does not go ahead for 2006. EnCana’s Deep Panuke fails to materialize due to a re-evaluation of the economics by EnCana. (EnCana has called a ‘time-out’ on the regulatory review, to undertake additional project evaluation). This decision by EnCana, and smaller scale exploration programs by other producers, decreases the level of exploration activity on the Scotian Shelf (especially during the next 18 months) to the end of 2004. This change has a significant influence on investment during the second five-year period.

In the longer term, due to discouraging exploration results, further development in offshore Nova Scotia is slowed, resulting in flat production. Regulatory frameworks are not streamlined and continue to discourage investment, while negative stakeholder influences reduce the attractiveness of East Coast investment.

**Newfoundland and Labrador Scenarios**

The following figure presents both the high and low case oil production scenarios for Newfoundland and Labrador.



Under the high case scenario, Husky's White Rose oil project on the Grand Banks goes ahead as planned. White Rose's natural gas play is developed earlier due to gas prices and discovered resources (later part of the five-year outlook). This development results in the examination of gas transportation options (offshore pipeline or compressed natural gas (CNG) vessels) in the second period (6-10 years). Exploration on Newfoundland's West Coast becomes economic, encouraging additional exploration activity. There is an increased need for terminalling (above ground tankage and underground storage) and increased shuttle (tanker) requirements and operations on the Grand Banks.

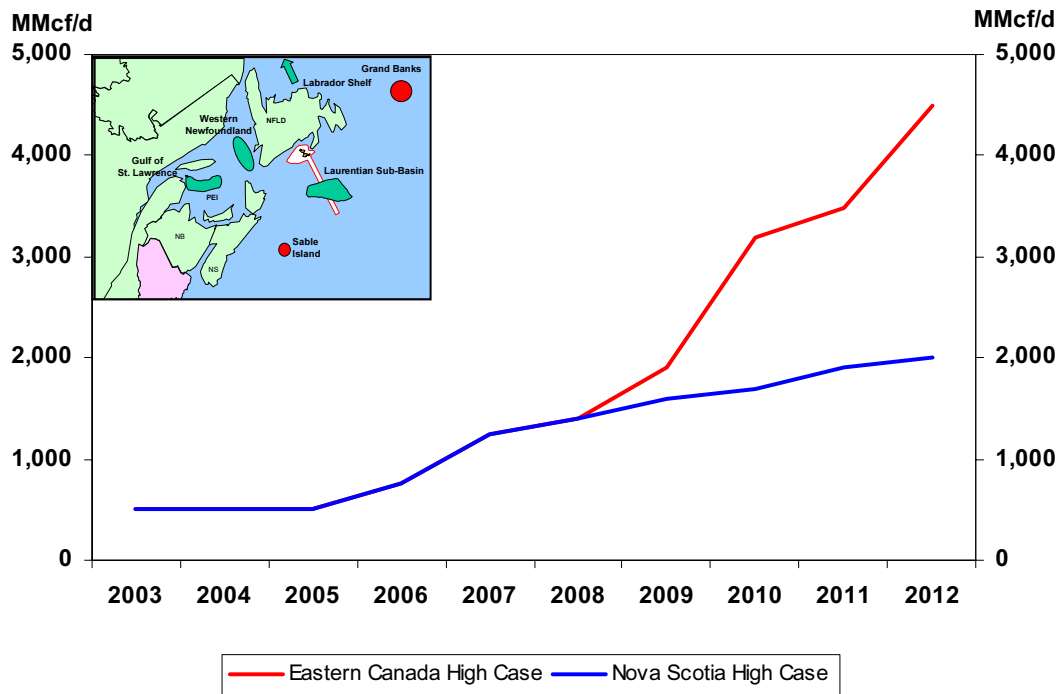
In the longer term, Newfoundland Grand Banks natural gas is connected to Newfoundland via some combination of offshore pipeline or CNG vessels. This stimulates the potential development of gas in other fields in these regions (Hebron, Ben Nevis) and more remote fields in the Flemish Pass. Newfoundland's west coast sees future exploration and development of crude oil, and perhaps, some natural gas. Production under the high case remains fairly flat over 10 years due to declining production in existing areas, balanced by gradual production increases in new developments such as White Rose.

Under the low case scenario, Husky's White Rose oil project on the Grand Banks goes ahead as planned, without development of the associated natural gas potential (> 250 MMcf/d) until after the 10-year timeframe. In the longer term, capital and operating costs are higher than projected revenues for new developments. Consequently, these developments are considered uneconomic and would likely not proceed. Other competitive options for Newfoundland gas supply such as lower cost LNG (liquefied natural gas) from abroad could preclude development in the area.

#### Eastern Canada Offshore Developments: High Case Only (Long-Term)

The figure below presents the high case scenario for Eastern Canada offshore gas which includes the Nova Scotia High Case, and gas from the Grand Banks, Labrador Shelf, Laurentian Sub-Basin, and the Gulf of St. Lawrence. In this high case only scenario, one 500 MMcf/d additional gas project beyond Sable 2 is proposed, which may be Deep Panuke.

## Other Eastern Canada Offshore Natural Gas



### High Case Scenario:

- Newfoundland and Labrador gas may interconnect with Nova Scotia in the long-term, beyond 2008;
- Exploration successes on the East Coast of Canada stimulate additional developments within the region;
- Cooperation among provincial/territorial and federal governments are positive from a regional perspective; and
- Other developments (due to the early stage, these should be viewed as speculative):
  - Hydro Quebec may be successful in the Gulf of St. Lawrence with its exploration, and a combination LNG/CNG pipeline is constructed to natural gas deliveries to Quebec and eastern Ontario;
  - Greater exploration and potential development of the Laurentian Sub-Basin occurs; and
  - Potential development of the natural gas reserves on the Labrador Shelf (nearer the end of the 10-year outlook).

### Low Case Scenario:

The economic hurdle rate to drive activity requires a higher gas price, and consequently a low case is either uneconomic or no significant gas development activity is realized.

## Oil Sands Scenarios

In the 1990s and early 2000s, the existing projects have been expanded, in some cases significantly. Suncor Energy Inc. (Oil Sands Group) and Syncrude Canada Ltd. each produce about 10 per cent of Canada's crude oil output by mining the Athabasca bitumen deposit and upgrading the bitumen to synthetic light crude oil. Suncor produces 206,000 Bbl/d and Syncrude 230,000 Bbl/d. The new Athabasca Oil Sands Project (Shell Canada Limited, Chevron Canada Limited and Western Oil Sands L.P.) is planned to produce 155,000 Bbl/d by the third quarter of 2003.

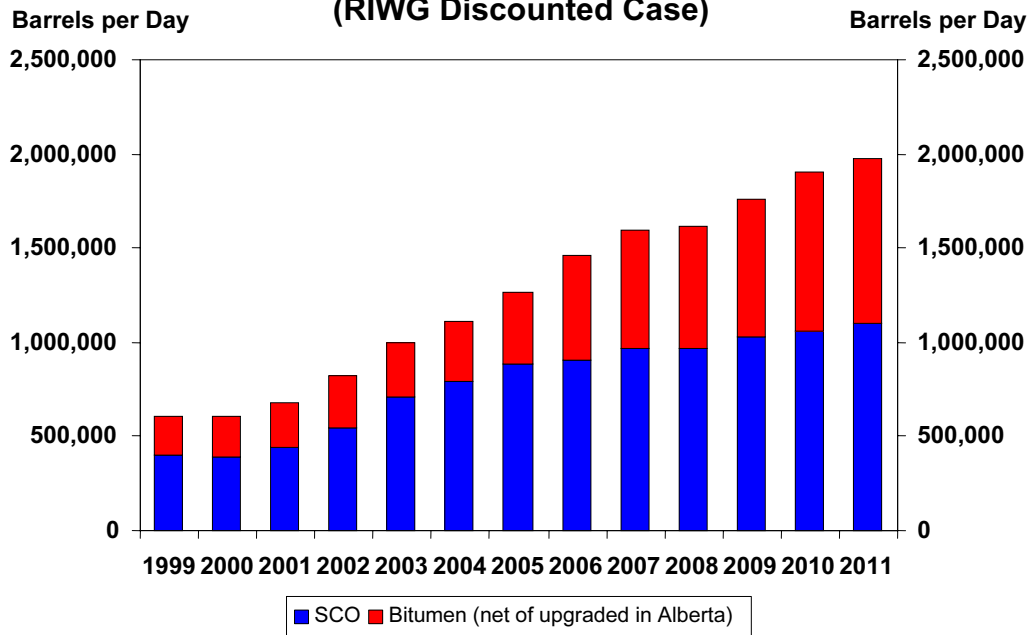
The regulatory process for all large Oil Sands projects is complex, involving multiple stakeholders and challenging issues such as environmental concerns. Standards of approval have increased significantly over time. This has made project front-end costs very high and discouraged some companies from participating.

A significant portion of new Oil Sands development relates to in-situ operations using steam assisted gravity drainage (SAGD) technology. SAGD technology uses two horizontal wells (one above the other). The upper well is injected with steam and the lower one is used for production. SAGD projects are about 10 per cent of the size of mining projects, and leave a smaller environmental footprint.

The Regional Issues Working Group (RIWG) has been established to assist industry and stakeholders in understanding projects and planning the mitigation of negative, cumulative impacts. This group works closely with governments and Aboriginal groups. RIWG has carried out workforce studies during the past five years and recently commissioned a study of the future labour needs in the Oil Sands area. RIWG has developed forecasts for this area, and these have been incorporated into our high and low case framework.

The RIWG discounted case is shown below (high case scenario). This case assumes both in-situ and mining projects proceed rapidly, new sources of diluent become available (use of light or synthetic crude) or pipelines are adapted to move higher viscosity blends. Developments which occur include: new grassroots mining projects, expansion of current in-situ pilots to larger commercial projects and continued debottlenecking/expansion of existing projects.

## Oil Sands Production High Case (RIWG Discounted Case)



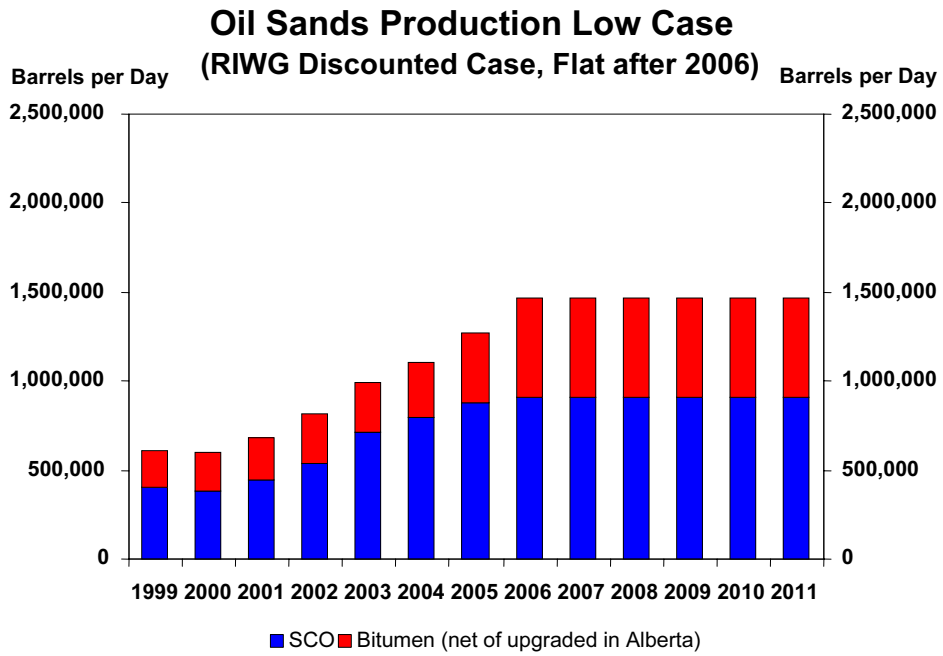
SCO = synthetic crude oil

Source: Regional Issues Working Group - April 2002

In the low case scenario (next page), development is constrained by any one or several of the following:

- Limited demand growth for heavy oil or bitumen blends from US refiners due to a lack of upgrading capacity;
- Reaching a ceiling in refinery demand for upgraded synthetic crude oil;
- Insufficient diluent for blending;
- Labour shortages inhibiting concurrent construction or expansion of plants or escalating the capital cost; or
- Onerous Kyoto Accord requirements.

The developments include continued operation of current in-situ pilots, but little expansion into larger projects, and continued debottlenecking of existing synthetic crude projects and upgrading of existing plants to meet environmental or market requirements.



SCO = synthetic crude oil

Source: Regional Issues Working Group - April 2002



## **Module 2 Overview: The Impact of Technology**

Through research, focus groups, interviews, and specialist consultation, we sought to understand the impact that technology may have on the industry. These implications have been examined and described by region (WCSB – exploration, drilling and production, Oil Sands, the North, and the East Coast).

The WCSB is in maturity/harvest mode and will focus on operational excellence to reduce costs and optimize production (revenue) so that profitability may be maximized. This approach has accelerated in recent years due to declines in conventional reserves and in average production per day per producing well, all leading to higher costs per unit of production and lower levels of profitability. As the upstream industry is a commodity industry (meaning it is a high volume/low margin business significantly affected by price fluctuations), operational excellence principles offer a strategy for optimizing returns in both high and low case environments.

As the frontier and new production regions are also in the commodity business, the operational excellence approach will support cost reduction and production optimization efforts there, too.

The Oil Sands area is in a strong growth phase and uses technology on a massive scale. Cost efficiency improvements of only a few percentage points can lead to multi-million dollar savings. As projects are developed, proven technology will be incorporated and continuous improvements will be made to optimize costs and address environmental and safety issues.

In the North, we expect proven and improved/leading-edge technology to be fully utilized to reduce costs, safety hazards, reduce downtime and improve reliability. These are issues that must be addressed in remote, Northern environments.

The same holds true for the East Coast where some new technology will be developed and proven technology from the Gulf of Mexico and the North Sea will be utilized. The issues of remote harsh environmental conditions will be a central technology and human challenge.

### **Technology Impacts**

Technology, which is critical to the Canadian upstream petroleum industry, has a significant impact on the associated workforce. During the last decade, there has been a major shift in the development of technology from E&P companies to service companies. A characteristic of many new technologies is a much shorter “cycle time” for the developer of a technology to benefit from their research and development investment. The rapid evolution of information technology has reduced the cost of many new oil and gas technologies, making them accessible to even small industry players.

Use of technology in the petroleum industry is variable. Some companies are innovators and others are early adopters, while most apply technology later in the life cycle.

The impact of technology can be viewed in a number of different ways:

- 'Breakthrough technology ' that fundamentally changes how things are done;
- Technology which reduces costs by being more efficient, accurate or quicker; and
- Technology which improves people performance by:
  - Handling larger volumes of data quickly;
  - Retrieving more knowledge from the data available; and
  - Facilitating increased access to external knowledge.

The following sections identify the regional trends and impacts of technology on human resources.

### **WCSB Exploration**

Identifying and developing new non-conventional gas reserves will require new technology and new skills. High-end geoscience and strong computer/reservoir modelling skills will be required as technology advances. There will be an evolution from integrated teams to individuals with multiple skills. These individuals will be supported by model-driven programs.

People: There will be increased focus on seismic processing, inversion, depth migration and importing techniques from other areas. As integrated teams evolve to individuals with multiple skills due to the maturity of the life cycle, individuals will need to be proficient in economics, geosciences and petrophysics – all supported by model-driven programs. Workflow processes will continue to improve, resulting in integration of knowledge across teams or individuals. As well, interactive workflow and sharing of skills will increase between E&P companies and service companies to optimize costs and inventories and to reduce cycle time.

Skill Needs: There will be less demand for specialists and more demand for integrated geoscientists. These individuals will need to be familiar with geological, geophysical, petrophysical and engineering analysis, and able to conduct economic evaluations. Other key skills will include: seismic interpreters, structural geologists experienced in compressional regimes, petrophysicists and IT professionals.

### **WCSB Drilling**

The industry appears to be evolving and specializing in two different areas. The first is fast drilling and completions for simple wells required for commercial development of shallow gas in eastern Alberta and Saskatchewan. Second, more complex drilling and completion projects for deeper, complicated wells requiring more advanced technology, (e.g. in the deep Foothills) and long directional wells used for thermal heavy oil production. The seasonality of work is a major issue for drilling and service rig contractors.

Most work occurs in the first and fourth quarters of the year, with far less work in the second and third quarters. This makes it difficult to attract people from traditional and new sources and to retain their skills. During the last winter drilling season, about 50 out of 660 rigs were inactive because of crew shortages, and 150 drilling rigs were understaffed.

Employee safety is a major industry concern. Canadian rig safety has generally lagged behind international standards and international E&P companies now operating in Canada are demanding higher standards of contractors. The Alberta Government has strict standards to be reached by the end of 2004.

People: Operating staff will focus on consistency of operations and process optimization, resulting in lower operating costs. There will also be more focus on preventive maintenance to reduce unscheduled downtime. More maintenance work will be outsourced.

Skill Needs: With advancing rig automation, more roughnecks and operators will operate in cabs above the floor using joystick controls and computer consoles vs. traditional levers. Hydraulic rigs are becoming more common, and this type of technology requires hydraulics training that is not a requirement on conventional rigs.

Other Trends: Given economic pressures, as well as the negative impact of seasonality on retention of skilled employees, there is a current push to smooth out the current seasonality of drilling. Statistics indicate that three-quarters of the wells can be drilled at any time during the year. This initiative may lead to reducing the severe seasonality of this sector by providing year round work for drillers. In addition, CAODC and the Alberta government are undertaking a joint process to create a compulsory trades certification program that will result in a career ladder with three trades designations for drilling workers to enhance consistency of training in this sector. Optimizing the drilling cycle, reducing the seasonality of the work and providing workers with training, certification and a career ladder may address current attraction and turnover issues among skilled workers.

### **WCSB Production**

Production will continue to decline in traditional conventional areas, encouraging companies to be more efficient and cost conscious. Non-conventional energy sources (coal bed methane, tight gas, deep gas) requiring new technology will be pursued to offset conventional declines. Enhanced recovery techniques can provide the WCSB with access to reserves that are otherwise inaccessible or uneconomic to produce. The implication is that the WCSB may remain in the maturity/harvest mode longer, with a lower production decline. As in exploration and drilling, production technology research and development is moving from the E&P companies to the service companies.

**People:** With a declining resource base, companies must increase the efficiency of their operations by using fewer but more highly skilled people. Using modern information systems and automation tools, operators are required to conduct fewer well checks and can manage more wells. The number of field operators per well will continue to decline as technological improvements are applied. More unplanned maintenance repair work will be outsourced, leaving traditional production trades to focus on preventative maintenance. Plants are benefiting from automation and potential staff efficiency gains may be achieved by centralizing control using wireless, satellite or Internet-based technologies.

**Skill Needs:** The efficient harvest of the basin depends on using more efficient techniques. Consequently, there is a growing need for people with IT, instrumentation, Supervisory Control And Data Acquisition (SCADA) and wireless communication skills. For existing and new operations people, upgrading IT, data management and console skills will be critical. Working on trucks/wireline equipment requires more intensive training than in the past. Instead of constant repair, there will more preventative maintenance.

Professional roles will evolve. For example, reservoir engineers are becoming exploitation managers. Engineers will also need to manage energy and emissions auditing, as well as design, testing, and implementation for oil and gas operations. The demand for these skills may increase significantly as a result of higher energy costs and environmental emission constraints.

**Technology:** The industry focuses on continuous improvement and automation of technology. Equipment is being designed to be more reliable, and more efficient so less servicing is needed, leading to lower per unit costs and higher productivity. As a result, production fields are becoming more automated each year requiring fewer people.

## **Oil Sands**

The Oil Sands area is in a strong growth mode, which requires a full range of skilled operators. The mining aspects will focus on more integration of IT and continuous improvements in efficiency and operations, as efficiency gains and improvements can have a significant impact on these projects.

In-situ and mining projects and upgraders use technology competitively to lower costs. The departure of existing staff remains a challenge. Few cross-trained staff are available who can integrate the breadth of technologies required by each project. A key technology development area will be a reduction in energy use to improve profitability and meet greenhouse gas emission targets. In the medium-term, the Oil Sands industry will continue to require increased quantity and quality of data management, develop new upgrading concepts that reduce the required capital, and improve product quality/yield and energy efficiency, with the cogeneration of heat and power. In-situ projects will continue to realize cost reductions in directional drilling or multilateral wells, enhanced reservoir modelling and down-hole data collection, and the development of enhanced artificial lift.

**People:** There will be a growing demand for a full range of professionals, trades and construction workers for mining, in-situ and upgrading activities. IT technology will continue to be an expected competency among workers.

### Skill Needs:

**Mining:** Heavy equipment operators, welders, mechanics, and electricians are required. At the professional level, mine engineers and planners, geologists and geophysicists, surveyors, and chemical and mineral processing engineers are needed. Mining operations disturb large tracks of land, and environmental experts are required to develop plans, study problems and support ongoing remediation and reclamation.

**In-situ:** In-situ operations resemble conventional oil production processes and require skilled drillers, geologists and geophysicists and production engineers. Steam engineers and water treatment specialists like chemists or chemical technicians will also be required as will reservoir engineers with steam knowledge. Environmentalists are required for monitoring and addressing impacts. There is also a continuing need for various technicians for in-situ operations. Dual trade tickets are becoming more common, reflecting the theme of broader skill requirements.

**Upgrader:** Upgrader operations are similar to refineries or gas and chemical plants. Computer consoles are used to control operations remotely. Key skills include: process operators, process engineers, chemical engineers, mechanical engineers, corrosion specialists, and Health, Safety and Environment (HS&E) professionals. Upgrader construction requires design engineers, project managers, pipe fitters, welders, millwrights, mechanics, concrete trades, and technicians to monitor the process.

**Technology:** There will be an increase in the quantity of data, and quality of data management, requiring strong IT skills.

**Other Trends:** Partnerships between industry and educational institutions like Keyano College for universal training, as well partnerships between companies (joint emergency response) are being implemented to ensure consistently trained staff and lower costs. We will see a continued focus on environmental issues and continuous improvement of operations.

### **The North**

Explorers and producers want to create a trained and sustainable local workforce. The key challenges will include climate, attraction and retention of skilled labour in this remote area. Given this, E&P skills are transferable from the WCSB to northern exploration and production operations, particularly as the WCSB moves through the harvest phase of its life cycle. Operating the pipeline will require very few operators due to highly automated and reliable technology, and most jobs will be in the upstream E&P sector. This will occur as soon as the pipeline is a reality, so that gas finds can be commercialized. Few technology challenges are expected as the North will employ existing, proven and leading-edge technology. This will encourage an operationally excellent environment, leading to a low total cost of operations.

**People:** There is a need for additional research into the ability of people to work in harsh, cold climates and remote areas. This could provide strategies and approaches for attracting, integrating and retaining workers in this region, and helping them to be fully productive. Aboriginal Peoples, as well as other Northern residents, will likely be a key resource as they are already acclimated and available locally. Training and development programs will need to be tailored to this source of labour.

**Skill Needs:** Construction of the large diameter, high pressure pipeline would be completed over two winters, requiring 2,400 – 3,000 construction workers, specialized welders, side-boom operators, back hoe operators, project managers and design engineers. Once the pipeline is in service, approximately 50 staff will be required to operate and maintain it.

To support the pipeline volumes, E&P skill needs will include the traditional exploration and production skills, but with expertise and experience in harsh, cold and remote locations.

**Other Trends:** The issue of access to Aboriginal lands will likely be resolved, and there will be significant efforts made to employ local residents in long-term roles. The aim of both the Northern population and the companies developing the North is to develop employment and business capacity. Sustainability of jobs is an important consideration for the region. There is a desire to create a mobile, trained workforce with transferable skills so as not to create a boom-and-bust situation that would be disruptive. Partnerships between Aboriginal groups and E&P companies are needed to create this outcome. E&P jobs will be in demand in the region as there will be a need for drilling and production activities to expand production and maximize the utilization of the pipeline.

### **The East Coast**

This region is in startup mode and demands a wide variety of professionals and trades working in multi-disciplined teams. Remoteness and harsh climate conditions associated with offshore occupations will influence the availability of workers. A full range of technology and skills will be required to optimize basin modelling, exploration and completions while minimizing costs and delays. As the East Coast industry grows, there will be a demand for both highly skilled professionals and associated development programs. Once the WCSB moves into harvest mode, some of these professionals are expected to migrate to the East Coast industry.

In the medium-term, there will be increased need for special exploration technologies including sequence stratigraphy and basin modelling (source and migration), hydrodynamic modelling and remote sensing. Technology to mitigate accumulative environment effects and control environmental risks and emergency response will be critical and need to be continually assessed as overall E&P activities. Satellite monitoring and remote sensing technologies for the offshore areas will become more important.

There will be a continuing drive to improve the integration of all types of subsurface data including seismic, drilling, well data, geologic and stratigraphic information into subsurface models. Geoscientists and engineers will be required to develop new skill sets to effectively use integration technologies. Key technologies of increasing

importance include flow assurance, pipeline/flowlines, umbilicals, sub-sea wells, sub-sea processing, instrumentation and automation.

**People:** There will be a need for a full spectrum of engineers, technicians, operators, maintenance workers, explorers, drillers, construction workers and related professionals. Trades will also grow. As well, the harsh climate of the East Coast offshore will need to be factored into related work practices and human resource programs.

**Skill Needs:** The ability to work and thrive in a multi-discipline team environment is a necessity, and team leaders will be called on to manage in an integrated fashion. A full range of geoscientist and engineering skills, electrical and control skills, project management and computer literacy will be critical, as will marine skills in operations and logistics support and construction. The need for remote control of operations and the extension of fields, both in the construction and operation aspects, will likely increase. Robotics may play a larger role.

**Other Trends:** Trained professionals and trades may migrate from the WCSB to the East Coast where their skills will be more in demand. Schools serving the marine industry will be proactive in developing relevant marine engineering and technologist programs. Benefit programs in the Atlantic requires E&P companies to provide research and development as well as training and development funding to local regions.

## **Module 3 Overview: Employment and Workplace Analysis**

### **Background**

The oil and gas industry is centered in Alberta, with most exploration and production (E&P) companies headquartered in Calgary. While the operations of the Oil Sands companies are based in northeastern Alberta, the parents of the operating companies are based in Calgary. The majority of the pipeline and midstream companies are also in Calgary. While the largest service companies are based in Calgary, they have operational units that are field-based throughout the WCSB and on the East Coast. Smaller service companies are often based in the operating region they serve.

The industry has been rationalizing and restructuring over the past two decades. This rationalization has resulted in streamlined operations and a reduction of functions or positions. Most recently, there has been a rise in royalty trusts. Royalty trusts are primarily harvesters and producers of the resource. The key objective of the royalty trust is to maximize cash return to shareholders. Under this model, risks and costs are minimized by focusing on efficient production practices and by undertaking only low-risk drilling activity.

This restructuring has had a significant impact on human resources in the industry. Previously, few Canadian E&P companies had experienced significant involuntary staff reductions. Since the collapse of oil prices in 1986, almost all major E&P companies restructured and reduced their staff. This resulted in an overall structural shift with many displaced employees becoming permanent contractors. While many of the larger companies in the oil and gas industry had previously hired many new technical and professional graduates, they more or less stopped this practice for several years and only recently resumed it on a smaller scale. While there has been a general aging of the working population, the void in hiring new graduates for a significant number of years has worsened concerns about shortages of replacements for the aging baby boomer population that represents a significant percentage of the total working population of the oil and gas industry.

While the different sectors of the industry (E&P, midstream, pipelines, and services) have different operational models, many of their human resources issues are similar. Similar skill requirements across the different sectors result in a high degree of employee mobility within the industry. This, in turn, results in a more homogenous approach to human resources policies and practices as companies compete for talent. The most significant determinants of human resources practices are the size of the company and its location. Smaller companies generally have less sophisticated human resources practices.

### **Demographics**

While this report focuses on the four primary regions of oil and gas development activity, several human resources issues are important nationally. For example, the Canadian population is aging across the country, with the rate being lowest in Alberta and highest in Newfoundland and Labrador. The North has more favourable demographics from the perspective of potential employers, but this is offset by the small size of the population. The aging population and the resulting negative impact on the availability of skilled workers were viewed as major human resources issues by all industry participants.



The Aboriginal population runs counter to this trend. Reported data on the Aboriginal population indicates a growth rate of 22.2 per cent from 1996 and 2001 while the growth rate for the non-Aboriginal population for the same time period is 3.4 per cent. Approximately half of this is attributable to demographic factors such as a high birth rate, while the balance is likely accounted for by increasing awareness of Aboriginal roots resulting in more accurate reporting. In addition, the median age of the Aboriginal population is 24.7 years and 37.7 years for the non-Aboriginal population. Canada's Aboriginal population has potential to be a solution to concerns about the future availability of skilled workers.

The following table provides an overview of demographics for the overall Canadian upstream oil and gas industry.

<b>IN-SCOPE POSITION CHARACTERISTICS – CANADA</b>		
	Industry Profile	% of Industry Population
Total - All Persons	120,040	
<b>Demographic Profile</b>		
Inter-provincial/inter-territorial migrants	11,160	9.3
External migrants (lived outside Canada five years ago)	2,680	2.2
Visible minority population	5,520	4.6
Aboriginal Peoples (self-identifying)	6,160	5.1
Persons self-employed (incorporated and unincorporated)	10,255	8.5
Immigrants	11,055	9.2
Persons who immigrated in 1996 or later	1,385	1.2
<b>Gender</b>		
Male	95,810	80
Female	24,230	20
<b>Age</b>		
15 - 29 years	33,205	27.7
30 - 44 years	51,690	43.1
45 - 59 years	30,710	25.6
60 years and older	4,435	3.7
Source: Statistics Canada 2001 Census		

### Human Resources Issues

Partly in response to demographics (the table above highlights that one-quarter of the oil and gas industry workforce is age 45 or older), and partly as a result of a desire to ensure continuity of business operations, industry participants across the country reported that succession planning is a key issue. While many companies have established succession plans for top management and key technical positions, the practice is not yet universal.

With respect to mobility, the issues vary significantly from one region to the next. Given that the industry remains centred in western Canada, however, it is generally recognized that some workers must relocate to remote locations while many others must work away from their homes on a temporary basis. Further, given the transferability of many skills across the industry, there is a high degree of mobility among employers.

The demographic information shows that approximately 12 per cent of the workforce migrated across provincial/territorial boundaries or from international locations within the last five years. A key issue identified by participants on the mobility of the workforce is the dual career family. The issue is exacerbated by the movement to remote locations where opportunities for spouses are limited.

The diversity of the workforce fares better in some regions than others, particularly with respect to the integration of Aboriginal workers in the North and the Oil Sands. In the WCSB, regulatory processes, particularly related to land access, create a business driver for Aboriginal participation in the industry. Local labour market planning is required to fulfill regulatory hiring commitments and creates human resource implications in terms of assessing and developing skills. On the East Coast, regulatory processes also support the need for diversity plans, which incorporate the inclusion of under-represented groups in employment and training opportunities. The industry continues to tap the labour pool that has traditionally provided skilled and unskilled labour, with the pressure of labour shortages starting to emerge in both groups.

Immigrants face formidable barriers to entry into the upstream oil and gas sector. While companies may secure scarce skills by hiring foreign workers, the landed immigrants, many of whom have high levels of education, are frustrated in their search for employment. One of the biggest challenges is the failure of professional organizations to recognize educational equivalencies or non-Canadian work experience. While some preliminary steps have been taken to integrate immigrant labour in the oil and gas industry, there is no sign the situation will change soon. The number of stakeholders who must co-operate to remove barriers so that immigrants can be a source of labour suggests little positive, short-term change. However, the rapid growth of the Aboriginal population may prove a more ready source of labour for the industry, especially as it continues to migrate to more remote regions.

About 10,000 workers in the upstream oil and gas industry, or about nine per cent of the total workforce, identified themselves as self-employed in the 2001 census. Individuals employed on contract are not considered part of the core workforce, are not usually included in headcounts, and are not included in human resources programs and initiatives. The exception is safety training, which is provided to all people within the work environment. Many of the E&P companies reported using contractors. Contract staff are sometimes used to fill critical skill gaps for short periods, with the intention of transferring their skills to permanent employees. In some cases, contract staff are used to meet restricted staff targets; in other cases, contract employees are used to manage peak workloads, short-term work assignments, periods of growth prior to production, and outsourced support and corporate functions. A limited number of companies report that the growth of their contractor workforce was, at least in part, a reaction to a renewed focus on cost effectiveness, headcount reduction, and the cyclical impact of the industry on human resources planning.

Human resources development should be looked at within the context of the strategic staffing needs of the industry. The industry has relied on compensation and benefits to attract new entrants to the industry. The Canadian oil and gas industry pays competitive levels of pay across the spectrum of positions. The industry recognizes that pay levels must exceed those in other industries to balance the issues of cyclical employment and remote work requirements. Many companies set compensation levels according to several database sources to ensure their pay practices are competitive. With respect to

benefits, the market percentile distribution for the value of benefits provided (pension, savings, and group insurance benefits combined) is greater in this sector than any other.

Candidates for oil and gas positions are primarily assessed based on their formal training requirements and Canadian work experience. The emerging approach of behaviour-based assessment for selection is a key barrier to employment of the non-traditional sources of labour as it generally requires relevant experience.

On the East Coast, regulations favour local candidates. The mobility of these workers throughout the East Coast offshore industry is an issue, as they are categorized according to permanent residency by province. Employers see this issue as creating serious financial and safety issues if a crew change is required on a vessel or rig due to the staffing regulations. Employers report some early success with negotiating aggregate agreements for employees that accommodate the requirements of the different jurisdictions.

How and where an organization should place its employees (geographically, functionally, and organizationally) is a key resource allocation decision. The decision implies determining the suitable number of employees to place against implementation of key strategies, defining the competencies required for organizational success, and considering possible tradeoffs between human and other (i.e., technological) resources. The oil and gas industry's response to the cyclical nature of the business during the 1990s created a perception that redeployment of key human resources was less likely to occur than downsizing.

### **Human Resources Practices**

While competitive pay and benefits help the industry retain workers, future retention strategies must go farther. With the exception of the conventional drilling and services sector, participants report that retention and turnover rates in the industry are not serious issues. Retention strategy focuses on specialized skill areas or geographic areas that are remote and for which it is difficult to recruit. Specifically, the Fort McMurray area, remote pipeline locations, and the Northwest Territories are areas where recruitment is focused and retention is important.

Management of the organization's workforce can represent either a significant competitive advantage or a major obstacle to business success. Effective management begins with workforce planning, the assessment of both external and internal labour force characteristics, and an assessment of the number of people with specific competencies required to execute the business strategy. The upstream oil and gas industry reports an optimal planning horizon of three to five years for workforce size and demographics. However, the industry also indicates that this timeframe is difficult to implement during merger and acquisition and commodity price cycles.

Further, the application of workforce planning is very low throughout the industry, with greater application in larger organizations. This is a serious observation when applied to the education, training and development model, which requires significant lead-time to respond to industry needs. Information on an aggregate industry level is either not available or not readily available for the training providers to assimilate into long planning cycles.

Internal trends reported in education, training and development in the industry focus on leadership development and, in some instances, succession planning. Many organizations are implementing leadership development programs to develop the competencies of managers across a broad spectrum.

## **Module 4 Overview: Skill Demand and Forecast**

### **Background**

The objective of module four was to assess the supply and demand of labour in the upstream oil and gas industry over the next five to 10 years to identify potential labour gaps. Such gaps may pose an issue for the oil and gas industry in that an excess of demand implies that work activity may be hampered by a shortage of workers, while excess supply leads to a workforce that is under-utilized.

The nature of the industry across the country makes regional demand analysis virtually mandatory. Three of the regions have already conducted such analyses.

In the case of the Oil Sands region, the labour demand analysis was undertaken by the Regional Issues Working Group (RIWG) and was current as of May 27, 2003. RIWG's analysis is part of a regular process of assessing the labour demand requirements of the Oil Sands sector.

For the East Coast, there have been recent labour demand analyses for both Newfoundland and Labrador (by the Petroleum Industry Human Resources Committee) and Nova Scotia (by the Petroleum Research Atlantic Canada – PRAC). Both of these studies forecast labour demand on the basis of the development of specific offshore projects and use industry experts to forecast the labour requirements of each project. Both studies use a range of scenarios to highlight how labour demand is affected under different market conditions for the forecast period.

For the North, development of a pipeline is required before industry activity is likely to increase significantly. This is not expected to happen before the latter half of the forecast period in the more optimistic scenario, or not before the end of the forecast period in the case of the less optimistic scenario. The current labour demand forecast for the oil and gas industry in the North is based on analysis undertaken by the Mackenzie Valley Pipeline Group. This group has developed a detailed forecast for permanent labour demand that will be created by the operation of a natural gas pipeline in the Mackenzie Valley. The labour demand for the operations of the producing fields that will supply the pipeline is highly speculative as the technology for the development of the producing fields has not yet been determined. The Mackenzie Valley Pipeline Group has, however, indicated that automation will be used where possible, thus decreasing the overall labour demand in comparison to that required by conventional producing properties.

For the WCSB, we have created a labour demand model that uses Statistics Canada data as the basis for current labour demand and then uses several different techniques to forecast labour demand over the forecast period. We had originally hoped to use the occupational survey that was distributed to upstream companies through their respective industry organizations but the survey response was too low to provide an accurate basis for either current labour demand or an estimate of changes in labour demand in the

future. Using Statistics Canada data does, however, provide advantages in that additional information about demographics has been gathered that allows for a more detailed analysis of labour attrition due to the aging population. A disadvantage of using Statistics Canada data is that the occupational classifications do not always match the more common industry usage or application.

There are advantages and disadvantages to using secondary sources of information for labour demand forecasts. The primary advantage is that this is an efficient way of collecting data that have been tested by the local industry participants. Project resources can therefore be applied in other areas such as labour supply analysis. Realistically, it would not have been feasible to gather the same data from industry participants again so closely on the heels of these other studies.

Study stakeholders from these regions indicated that using the secondary sources was preferable to re-gathering the data. The primary disadvantage is that these studies may not exactly match the market scenarios developed for this study on a region-by-region basis and some differences may need to be accounted for. Further, the occupational categories used in the secondary-sourced regional studies may not exactly align with the occupational categories used in the rest of this study.

Labour supply analysis for this study has been done by reviewing enrolment and graduation information from Statistics Canada that relates to educational programs that prepare people for work in the upstream oil and gas industry. We have reviewed the trends in enrolment rates over the most recent years to assess whether the supply of particular skill sets is growing, shrinking or staying about the same.

We have also included an analysis of potential attrition through retirements by reviewing the age demographics information for the existing workforce in each region. Note that it is not possible to predict the actual attrition rate due to retirements as this depends on a number of factors and would require more detailed demographic age information than is available from Statistics Canada. However, based on information for a sample of large E&P companies from pension actuaries, the retirement rate (defined as the percentage of people eligible to retire in a given year who actually do retire) is approximately eight per cent for employees age 56 to 60 and 20 per cent for employees aged 61 to 65. The average retirement age is 61 years.

## **Oil Sands**

The number of new hires forecasted over the next decade (approximately 8,600) exceeds the current direct employment level of just over 7,000. The most significant growth (approximately 50 per cent of overall growth) will occur in a very small number of occupations: heavy equipment operators, process operators, heavy duty mechanics and power engineers.

The high and low scenarios for the Oil Sands developed in Module One are based on the RIWG's modelling assumptions. Under the high case scenario, both in-situ and mining projects proceed rapidly, new sources of diluent become available (use of light or synthetic crude), or pipelines are adapted to move higher viscosity blends.

Another consideration for the Oil Sands region is that supply and demand gaps may be partially caused by the remoteness of the location as well as the dramatic growth of this sector of the oil and gas industry during the past several years. Positions that are reported to be difficult to fill at the present time include instrumentation technologists, power engineers, heavy duty mechanics and process operators.

The overall data indicate that a relatively high percentage of the current workforce in the Oil Sands will be eligible for retirement during the next 10 years.

## **North**

There is currently a very modest amount of oil and gas exploration activity in the North. Employment is highly seasonal, as oil and gas activity is largely limited to the winter. Three onshore natural gas fields have been proven and it is highly likely that more significant deposits will be found.

The key driver of more oil and gas development will be the building of a natural gas pipeline to southern markets. Under the high case scenario, a higher capacity pipeline (i.e., 36-inch diameter) is placed in service by mid-2008. This assumes that regulatory approval happens very quickly and that all development activity happens without delays.

Current employment in oil and gas in the North is highly variable and depends on exploration activity levels. Over the 2001/2002 season, direct employment in the oil and gas industry was 1,635 people. During the following year, (2002/2003), direct employment levels were only 860 people. Note that these numbers reflect only the total number of people employed but due to the short working season, the actual person-years of employment would be considerably less.

Permanent employment in the oil and gas industry in the North will only follow the development of a northern gas pipeline. Once in operation, approximately 50 people would be required to operate and maintain the pipeline system.

Employment levels associated with the operation and maintenance of the natural gas fields are more speculative as the technology to be used has not yet been defined. According to the Mackenzie Valley Pipeline Group, the gas field operations will be automated as much as possible, reducing the need for operational personnel over the usual requirements for more conventional field operations. One estimate for the number of permanent positions created as a result of field operations, not including pipeline operations, is 200. This number is likely understated as the initial field development will likely be followed by more exploration and development, and therefore more operational gas fields.

## **East Coast**

The Petroleum Research Atlantic Canada (PRAC) commissioned a demand model for human resources in 2002. This comprehensive study includes a modelling function to predict the human resources needs for the industry in Nova Scotia based on scenarios that reflect specific assumptions. Analysis of the five scenarios indicates that the scenarios "low and moderate" are comparable to the Module One scenarios (low and high cases). Analysis of the demand requirements is derived from the PRAC model forecasted for these scenarios.

The changes in labour demand are driven by offshore exploration and development activity which is “lumpy” in that each major project creates a step-function change in labour demand. Labour demand change is not constant throughout the forecast period. Under the high case scenario, there is a short-term peak in labour demand in 2004 (at 3,637) which falls off and then peaks again during 2010 to 2012 (at 5,296) from a 2002 level of 1,635. Under the low case scenario, while the labour demand (which peaks in 2004 at 3,141) is significant relative to the 2002 employment levels of 1,160 and demand for a few occupations increases by more than 200 per cent, the period of high demand is extremely limited and demand across all occupations falls quickly and becomes relatively level during the forecast period.

The overall data indicate that the workforce distribution for workers in the age 15 to 29 category and the age 45 and older category are approximately equivalent. The largest concentration of workers is in the age 30 to 44 category at 46 per cent.

In May 2003, the Petroleum Industry Human Resources Committee (PIHRC) whose members include representatives of NOIA, CAPP, the Provincial Government of Newfoundland and the Federal Government, published the “Labour Market Assessment of the Offshore Oil and Gas Industry Supply and Service Sector in Newfoundland and Labrador”. This study is a comprehensive review of current occupations linked directly and indirectly to the upstream oil and gas industry in the region. The study quantifies the number of current incumbents in approximately 340 occupations and projects the number of incumbents who will be required based on potential demand scenarios. Construction and commissioning of new operations were not within the scope of this study.

Under the high case, employment rises from a current level of 1,330 (this number is based on the in-scope occupations of the national study and represents a subset of the broader scope of occupations listed in the PIHRC study) by another 850 positions. We have applied the high and low case scenarios utilizing the scenarios identified in module one of this national study. The Newfoundland and Labrador high case scenario creates significant short-term pressure in the labour supply for a large number of positions primarily grouped as technicians, technologists, engineers and marine occupations. Labour demand rises sharply as additional facilities become operational and then levels off through 2012. While the sequential development of facilities places less strain on labour supply, the high case scenario requires concurrent construction and operations of facilities, therefore creating considerable strain on the supply of skilled labour.

Under the low case, employment increases more moderately by only 323 from the current level of 1,330. The increase that is reported in the low case scenario is significant to the Newfoundland and Labrador labour market. This demand is created by the White Rose Project – which has been announced and therefore illustrates realized labour demand. Offsetting the demand is the movement of skilled workers as a project is completed and the next project becomes feasible. Indeed, on the White Rose project labour mobility is a factor in supply. These positions were identified in the PIHRC study as difficult to recruit based on the short-term project based nature of the work. There is an industry-wide recognition of labour supply shortage and finding candidates with the requisite offshore environment experience.



Supply/demand gaps on the East Coast have been identified both by the PIHRC study and through primary data gathering in this study. The supply gaps most commonly cited include engineering positions, marine officer positions, drilling and rig management positions, and specialized offshore drilling and development positions. The most significant supply factor is the lack of sufficient experience in the offshore environment. The second most important factor impacting labour supply is the short-term or project-based nature of employment. The high degree of specialization required for many of the positions and the lack of permanent employment opportunities also creates difficulty in attracting qualified candidates from the labour pool.

## **WCSB**

To forecast the changes in labour demand for the WCSB, we established a relationship between the level of drilling activity and overall in-scope employment levels in the industry. Based on single variable regression analysis, drilling levels are the dominant driver for employment levels in the oil and gas industry. Additional drivers of employment levels that proved significant (but not dominant) were the price levels for oil and natural gas.

We recognize the inherent limitations of a small base data set in establishing predicative correlations. Even allowing for multi-variant regressions that provide robust regression statistics, care must be taken in interpreting and assessing the resulting labour demand analysis due to the inherent data limitations. Nevertheless, this method is the only feasible method for estimating labour demand over a multi-year period.

The number of wells drilled, the average oil price and the average gas price were determined in the cash flow analysis modelling for the WCSB in Module One. The results of the cash flow analysis were presented in high and low case scenarios. In the high case, the level of drilling activity peaks in 2003 (at 17,807 wells drilled) and declines to a low in 2012 (12,133 wells). In the low case scenario, the number of wells drilled also peaks in 2003 and declines more rapidly than in the high case to 10,201 wells by 2012. Commodity prices are generally higher in the high case and slightly lower in the low case scenarios respectively.

The analysis indicates that employment levels fall even less with a decline in drilling. The difference in the employment levels between the low and high case scenarios is approximately 76,000 and 79,500 by 2012 respectively, compared to 97,495 today.

While there are obvious shortcomings to the regression analysis done here (particularly in the limited sample used to derive the regression equations), there is some intuition behind the resulting labour demand forecasts. We would not, for example, expect employment levels to exactly match drilling levels. As drilling activity increases or decreases, the industry does not immediately adjust all occupation levels accordingly up or down. The regression results support this hypothesis. Changes in the nature of exploratory activity will also affect the relationship between the number of wells drilled and employment levels. A projected increase in deeper gas wells will decrease the number of wells drilled but may have less impact on employment levels as the wells take longer to drill and may take more technical effort to reach the point where a decision is made to proceed with the well.

For the purpose of establishing aggregate labour demand forecasts, we have assumed the relative proportion of employees in each occupation (based on NOC codes) will remain static over the forecast period. While this may not substantially degrade the overall modelling results, we recognize this is not a realistic assumption for individual occupations. We solicited expert opinion with regards to the impact that technology, changes in business processes, or decreased activity levels would have on employment levels of individual occupations at the National Occupational Classification (NOC) code level.

The vast majority of variances are driven by less seismic activity (due to lower drilling levels), an increased rate in the abandonment of wells leading to higher service company employment levels, the aging of pipelines and processing equipment (requiring increased maintenance), and more sophisticated technologies (including increased usage of directional drilling).

The overall data indicate that approximately 28 per cent of the total employee population is over the age of 45. Employees in the age 15 to 29 category represent approximately 29 per cent of the industry. This analysis indicates that there are fewer workers leaving the industry in the next 10 years than the current entry rate. The largest segment of the industry is the age 30 to 44 group at 43 per cent, who are more than 10 years away from retirement. However, as labour demand is falling in the WCSB, even positions with increased demand do not appear to create significant demand. For example, although primary production managers, geologists, geophysicists and petroleum engineers are within an aging demographic population, the fall in demand, in fact, offsets this issue.

The total percentage of workers in the upstream oil and gas industry who are immigrants to Canada is nine per cent. The total percentage of workers who immigrated since 1996 is one per cent. Note that this does not include foreign workers who are brought into Canada on temporary work visas. From this analysis, it is clear that immigrants are an important source of labour to the oil and gas industry

In the WCSB, where the vast majority of the industry's workers are employed, the industry is seasonal with a significant amount of drilling activity occurring in the winter months. The drilling, seismic and service sectors of the industry have all reported continual difficulty attracting and retaining skilled workers. This past winter, for example, as many as 150 drilling rigs were inactive or operated short of a crew as a result of insufficient staff to operate them. This creates concern within the industry around sustainability and safety. Traditionally, these industry sectors have drawn workers from rural areas, but this labour pool has shrunk. The industry's seasonality is also seen as an impediment to attracting and retaining a skilled workforce. Workers do not see long-term career opportunities in seasonal work.

Both quantitative and qualitative data were necessary to provide an accurate supply picture for occupations within the industry that do not require post-secondary training. These include apprenticeships and a number of entry-level positions in the seismic, service and drilling sectors. Looking at the data on the supply of untrained or unskilled workers in isolation would lead to the conclusion that there is no shortage. This labour pool is significant and available to industry. However, relying solely on this statistic is misleading because most of the industry cannot utilize the "unskilled" worker to a great degree. In fact, the majority of the industry reports that the standard for entry-level skills has risen, and now includes literacy of technical language and essential employability

skills and aptitudes across a broad range of competencies (i.e. mechanical aptitude, exposure to technology, and literacy). Therefore, most of the industry can only use that segment of the unskilled labour force with the requisite entry-level skills.

The geophysical service sector may be the exception, as many of their field crew positions are similar to those of general labourers and do not require prior skills or training. However, they still compete with a number of other industries for general labourers and the sector is challenged because their work currently is seasonal and does not have the same competitive compensation other sectors of the industry enjoy. This sector once met its requirements from the rural labour pool, but that labour pool has shrunk appreciably in recent years.

To counteract these factors, industry associations have addressed systemic barriers to the attraction and retention of workers. These solutions include optimizing the drilling cycle to address the seasonality of the work, and developing and implementing competency-based programs that provide workers with a career path and with the skills to mitigate safety concerns. Post-secondary institutions are also developing ways to assist industry in assessing and qualifying workers from the “unskilled labour pool”. Keyano College and Bow Valley College in Alberta are developing essential skills assessment tools.

Supply/demand gaps for professional and technical occupations within the WCSB have been limited to “hot skills”, defined as a particular occupation where demand temporarily exceeds supply. This phenomenon is attributed to the boom-and-bust cycle of the industry where industry has reacted by restructuring with significant downsizing. This has resulted in the loss of a number of experienced, mid-career employees, and has negatively affected the public perception of the stability and growth of the industry. One result has been the failure of the industry to attract new entrants, which created demographic gaps in some occupations. At the end of the last century, for example, the demand for certain information technology professionals exceeded supply. There have been periods where engineers, geologists, and geophysicists have been in short supply relative to demand. Most recently, production accountants have been a hot skill in the WCSB.

### **Long-Term**

Long-term labour supply/demand gaps can be assessed on the basis of the labour demand forecasts that have been reported, as well as an analysis of those occupations that are at higher risk to loss of workers through retirement. Total employment as at 2002 was approximately 110,000 workers directly employed in the entire upstream oil and gas industry, spread among the four regions. Under the high case scenario, the net increase in employment across all four regions is approximately 7,000 by the end of the forecast period. Under the low case scenario, the net change in employment is a decrease of approximately 1,500 by the end of the 10-year forecast period.

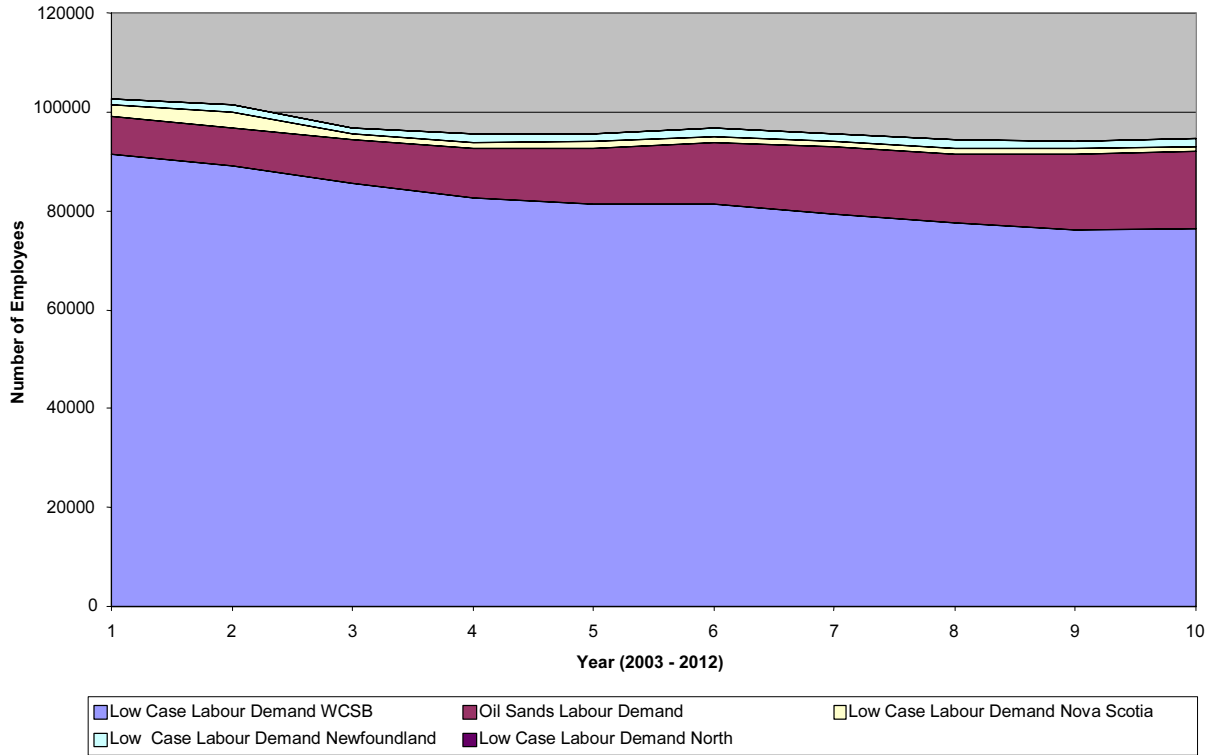
However, the figures for employment for the industry as a whole do not reflect significant regional changes in employment distribution. In both scenarios, a significant increase in employment in the Oil Sands is offset by the decrease in employment for the WCSB.

The overall trend for enrolment for training and education programs that lead to employment in the upstream oil and gas industry has been up, though the increase is approximately that of the overall increase in the Canadian population. There is no reason to conclude that there will be an overall supply gap as a direct result of shortages in skilled applicants, except in select hot skills that may materialize on a regional basis.

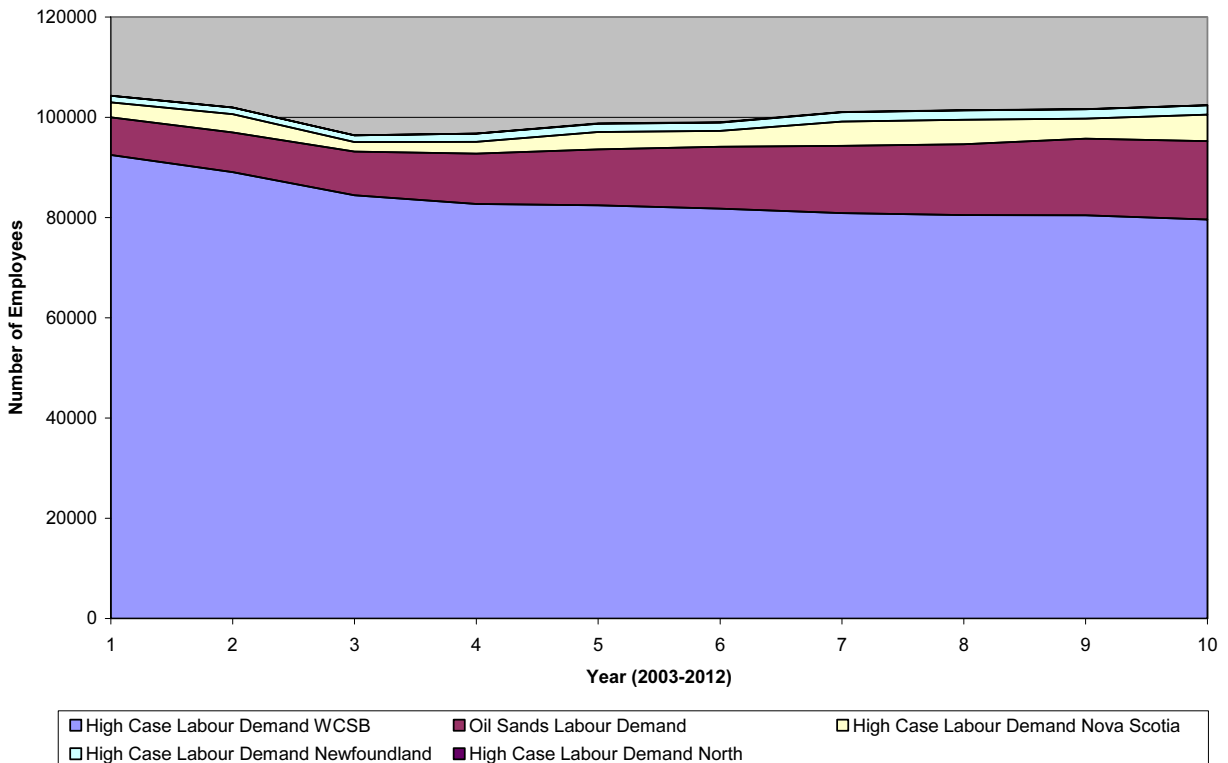
The geographic dispersion of the upstream oil and gas industry makes it difficult to generalize about industry-wide labour supply/demand gaps. Rather, the different nature of each of the regions, as well as the resultant local industry structure, requires that such gaps be reviewed on a regional basis.

The charts below illustrate the aggregate industry labour demand in both the low and high case. In the low case, there is a steady gradual decline in the aggregate demand during the next 10 years. In the high case, we observe a slight decline from 2003 levels during the next two years, then an increase and stabilization in 2008 through 2012 back to 2003 levels. This increase in demand in the high case is due to growth and production increases in the frontier and new production regions.

Aggregate Industry Labour Demand - Low Case



Aggregate Industry Labour Demand - High Case



## North

While the construction of a pipeline and related production facilities to tap into Northern gas may result in short-term labour pressures for the construction industry, the relatively small number of permanent positions to be created in the North once the pipeline commences operations, even relative to the size of the local labour pool, suggests that there will not be a resulting gap in the balance between labour demand and supply.

## Oil Sands

The Oil Sands is currently expected to double its direct employment levels within the next ten years. Further, 39 per cent of the current overall workforce is aged 45 and older and for a significant number of occupational categories, the number of workers age 45 and older exceeds 50 per cent. Based on these figures, it is highly likely that the Oil Sands will face shortages of skilled workers in a number of areas during the next 10 years. Occupations that face particular risk for supply gaps are heavy equipment operators, process operators, heavy duty mechanics and power engineers due to the magnitude of their projected growth (4,121 hires are forecasted by 2012 over current employment levels of 2,380). The training period for heavy equipment operators is shorter than for process operators and power engineers so these latter two occupational categories pose a more significant risk. The attraction of new workers to accommodate the expansion in the Oil Sands is exacerbated by current local conditions, specifically housing shortages, adequate medical and education infrastructure. This negatively impacts the mobility of labour to the area.

## East Coast

Under the high case scenarios (for both Nova Scotia and Newfoundland and Labrador) the total increase in employment versus current levels is approximately 4,500 employees by the end of the forecast period (assuming that the high case employment peak for Newfoundland and Labrador corresponds with the end of the forecast period). This is an increase of 150 per cent — a substantial increase given the size of the local industry. In the low case, however, employment increases by only a marginal amount (about five per cent). The significant differences between the employment forecasts under the high and low scenarios suggests that potential labour supply/demand gaps will be largely driven by actual industry activity levels, which will reflect the success of activity in this relatively new area. Under the high case scenario, positions that will experience significant increases in demand will include a range of engineering positions as well as some marine-related positions.

Approximately 25 per cent of the total East Coast oil and gas workforce is age 45 or older. On this basis, the aging of the workforce will not be as significant a driver of labour demand as in other regions.

## WCSB

The WCSB is expected to have lower employment levels under both the high and low case scenarios. The key factor driving the labour supply/demand gap will be whether the rate of attrition through retirements exceeds the rate at which employment levels will fall due to declining drilling activity. Currently, approximately 28 per cent of all workers in the

WCSB are age 45 or older. Overall, given the retirement rates, the decrease in projected labour demand will be roughly balanced by the expected retirements.

However, there will continue to be “hot skills” where shortages of labour will manifest themselves. Many critical in-scope occupations have in excess of 40 per cent of the labour force that are age 45 and older. These include engineering, technology and operations-related positions. In some cases, demand for some key occupations will also increase as a result of technology or changes to business processes. These also include engineers (electrical and chemical, among others), technicians (electrical and instrumentation in particular) and environmental positions.

### Occupations with Significant Changes in Demand

The following table highlights occupations by region that are expected to have significant changes in demand during the next decade.

<b>OCCUPATIONS EXPECTED TO HAVE SIGNIFICANT CHANGES IN DEMAND IN THE NEXT DECADE</b>				
<b>WCSB****</b>	<b>Oil Sands*</b>	<b>Nova Scotia**</b>	<b>Newfoundland and Labrador***</b>	<b>North</b>
Electrical Engineer	Operations: Heavy Equipment Operators (increase of 2,313)	General Labour (808 increase)	Deck Hand (increase of 152)	Total of approximately 50 positions in four classifications are forecasted for Pipeline Operations.
Instrumentation Engineer	Operations: Process Operators (increase of 1,433)	Seaman (440 increase)	Second Mate (increase of 41)	Process/field operators (20 increase)
Instrumentation Technician	Maintenance: Heavy Duty Mechanics (increase of 1,138)	Engine Room Operator (196 increase)	Engineering Technologist/ Technician (increase of 39)	Technicians (General) 13 increase
Industrial Electrician	Operations: Power Engineers (increase of 375)	Welder (181 increase)	Production Technician (increase of 36)	Mechanics (5 increase)
Industrial Millwright	Maintenance: Electricians (increase of 317)	Rigger (136 increase)	Captain/Master (increase of 34)	Welders (3 increase)
MWD (Measurement While Drilling) Specialist	Maintenance: Motor Vehicle Mechanics (increase of 246)	Ships Officer (127 increase)	Chief Engineer (increase of 34)	Electrical/ Instrumentation (6 increase)
MWD (Measurement While Drilling) Coordinator	Maintenance: Millwrights (increase of 244)	Caterer (124 increase)	First Mate (increase of 34)	
Stationary Engineer	Maintenance: Instrument Technicians (increase of 187)	Pipefitter (115 increase)	Second Engineer (increase of 32)	

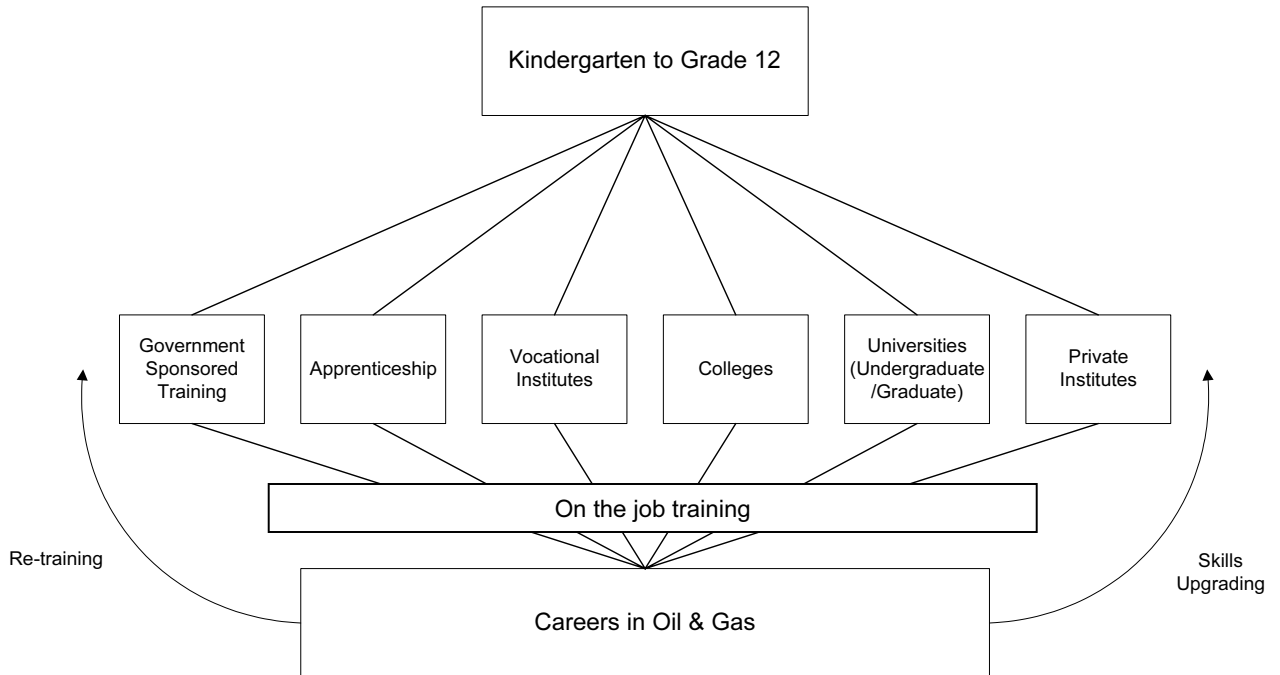
<b>OCCUPATIONS EXPECTED TO HAVE SIGNIFICANT CHANGES IN DEMAND IN THE NEXT DECADE</b>				
<b>WCSB****</b>	<b>Oil Sands*</b>	<b>Nova Scotia**</b>	<b>Newfoundland and Labrador***</b>	<b>North</b>
Quality Assurance Analyst	Maintenance: Others (increase of 181)	Electrician (108 increase)	Instrumentation /Electronics Technician (increase of 30)	
Process Operator	Maintenance: Steamfitters/ Pipefitters/Gasfitters (increase of 166)	Plater (105 increase)	Surveyor Technologist (increase of 27)	
Supervisors, Oil and Gas Drilling & Services	Administrative: Supervision/Management (increase of 137)	Barge Engineer (48 increase)	Instrumentation /Controls Engineer (increase of 11)	
	Maintenance: Welders (increase of 132)	Well Engineer (37 increase)	Fourth Engineer (increase of 10)	
Seismic Acquisition – Seismic Permitting Coordinator <b>(Decrease)</b>	Technical Engineers: Process (increase of 123)	Marine Engineer (33 increase)	Third Engineer (increase of 10)	
	Technical Engineers: Mechanical (increase of 79)	Drilling Engineer (30 increase)		
	Technical Engineers: Others (increase of 63)	Geologist (22 increase)		
	Technical Engineers: Chemical (increase of 54)	Structural Engineer (20 increase)		
	Technical Engineers: Mining (increase of 53)	Engineering Management (17 increase)		
	Technical Engineers: Geotechnical (increase of 49)	Mechanical Engineer (10 increase)		
	Technical Engineers: Environmental (increase of 45)	Process Engineer (10 increase)		
		Piping Engineer (8 increase)		
		Electrical Engineer (7 increase)		
		Civil Engineer (3 increase)		
		Corrosion Engineer (1 increase)		



<b>OCCUPATIONS EXPECTED TO HAVE SIGNIFICANT CHANGES IN DEMAND IN THE NEXT DECADE</b>				
<b>WCSB****</b>	<b>Oil Sands*</b>	<b>Nova Scotia**</b>	<b>Newfoundland and Labrador***</b>	<b>North</b>
<p>* Positions showing greatest change in demand from 2002 to 2012.                      ** Moderate/high case scenario positions showing greatest increase in demand from 2002 to 2013.                      *** High case scenario (three Floating, Production, Storage and Offloading (FPSO) vessels).                      ****Note: The WCSB high demand occupations cannot be reported in absolute numbers due to the data collection methodology utilized. Statistical data according to the NOC (National Occupational Classification) codes has been utilized for the WCSB.</p> <p>Each NOC code includes several job classes. For example: NOC 2145 Petroleum Engineers includes the positions of Drilling, Petroleum, Reservoir, Well Services (Testing, Field, Wireline) and Field Engineer. The discreet number of these engineering job classes is not available within this aggregate data.</p> <p>Based on the total employment modeling of the WCSB, (which indicated a downward trend in employment for this region), expert analysis of each job class within the NOC codes has been undertaken. Job classes where growth is expected to occur, notwithstanding the downward trend predicted in employment levels, are reported above.</p>				

## Module 5 Overview: Training and Human Resource Development

This module examines the education, training and development framework in Canada that provides skilled workers to the upstream oil and gas industry. It also looks at the issues and concerns of the stakeholders, in particular the training institutions and the companies that hire workers from these programs.



The cost of a post-secondary education in Canada is significant. The trend over the past decade has been to transfer an increasing amount of the cost to the student. Nationally, tuition fees have increased by an average of 125 per cent between 1990/1991 and 2000/2001 with Alberta experiencing the highest rate of increase at 208.8 per cent. For many potential candidates, the lack of entrance prerequisites, particularly due to the heavy math and science emphasis, remains an issue. The responsiveness of the education, training and development model varies significantly. Private training schools report that they can respond very quickly to industry requests for training programs. For accredited programs, colleges and institutes report that, at best, a one-year planning cycle is required to implement major changes. Universities report a planning cycle of more than one year.

Industry has become a partner with educational institutions by providing financial support, equipment for training, access to internal company training for educators, and partnership initiatives. However, it is reported that industry is failing to offer the necessary relevant co-op placements required by students. There is consensus among industry and training providers that co-op programs are an integral part of the experience students need to translate their formal education into practical knowledge. Co-op programs are offered at most institutions that provide graduates to the oil and gas industry and are, in fact, a preferred hiring consideration. However, the industry has decreased its participation levels with co-op programs, citing difficulty providing the necessary mentoring by employees.

Both the federal and provincial/territorial governments are active in sponsoring programs that support the education and training of workers for the industry. At the provincial level in Alberta and territorial level in NWT, there are programs that encourage high school students to gain work experience in the industry, as well as experience programs that provide credit

for work terms and support apprenticeship training. The federal government sponsors programs that can be administered either provincially/territorially or federally to identify gaps in qualifications and experience of candidates and facilitate development for targeted labour shortage areas. The design of these programs is focused on filling particular needs of either employers or candidates and covers a wide range of possible contracts.

The petroleum sector uses trades from a variety of traditional trade programs (including electricians, gasfitters/pipefitters, crane operators, welders, millwrights, carpenters, insulators, machinists, heavy duty equipment mechanics, truck and transport mechanics and steam operators) and at present does not recognize a petroleum trade. Alberta Apprenticeship and the Canadian Association of Oilwell Drilling Contractors is currently in the process of developing a trade program for oilwell drillers. Trade programs are a combination of academic or formal training, which is provided by a technical institute or college, and time spent employed to complete the required hours of experience. Apprentices are usually paid a percentage of the wage set by the employer for a journeyman, and the wage rate increases each year as the apprentice becomes more qualified. Standards for apprenticeship and journeyman are set by the industry and are determined in each province or territory for each trade. Although support for dual trades through multi-skilling or cross-skilling initiatives exists in the industry, cautionary flags have been raised in that the opportunity to offer a trade apprenticeship to a new entrant in a younger age demographic may be more worthwhile in the long-term than dual skilling an older worker. In addition, for practical purposes, dual trades require the practice of both trades to remain current. Pursuing more than two trades is difficult due to the need to have hours performing all trade skills.

The completion rates for trades categorized by Statistics Canada as building construction trades, electrical and electronics related, industrial and mechanical, and motor vehicle and heavy equipment, have declined significantly over the past decade. However, from 1999 to 2000, the completion levels dropped less dramatically with the exception of industrial and mechanical, which experienced a reduction of completion rates of 25.8 per cent. Continued drops in completion rates could lead to fewer than expected trades graduates.

<b>REGISTERED APPRENTICESHIP COMPLETIONS</b>					
<b>Trade</b>	<b>1991 Actual Completions</b>	<b>1999 Actual Completions</b>	<b>2000 Actual Completions</b>	<b>1991-2000 % Change</b>	<b>1999-2000 % Change</b>
Building construction	3,602	2,224	2,076	-42.4	-6.7
Electrical, electronics, and related	3,393	2,763	2,739	-19.3	-0.9
Industrial and mechanical	1,941	2,188	1,624	-16.3	-25.8
Motor vehicle and heavy equipment	4,747	4,248	4,728	-0.4	11.3
<b>Total</b>	<b>13,683</b>	<b>11,423</b>	<b>11,167</b>	<b>-18.38</b>	<b>-.02</b>

Source: Statistics Canada, Registered Apprenticeship Training, The Daily, August 14, 2002.

The Interprovincial Standards (Red Seal) Program encourages standardization of provincial and territorial apprenticeship training and certification programs. Qualified trades persons have greater mobility between provinces or territories where there is participation for a trade by both jurisdictions. Trades persons thus have the opportunity to practice their trade across provinces or territories where it is designated without having to write further examinations.

The main impediment to entering trades reported by participants and echoed by the Conference Board of Canada, is the perception of parents that a university education is preferential to a trade program. Trade councils in Canada have initiated programs in an effort to dispel this issue. Participation levels for women in trades remain low, particularly in the trades that are prevalent in oil and gas, and are attributed to a lack of socialization towards trades work and a traditional bias of trades work as male work.

The Petroleum Services Association of Canada (PSAC) has developed the Petroleum Services Competency Program (PSCP) to establish industry standards for occupations in the well service sector. There are currently occupational standards for 31 field positions. Specific competencies for each position have been established and serve as the guidepost for demonstrated competence. The competencies are measured as the outcome of applying skills and knowledge on the job rather than through “pen and paper” testing.

Data on employer-sponsored training were gathered through the Human Resources Practices Survey and focus groups throughout the regions. Employers reported that an emerging trend is the emphasis on self-study and e-learning which requires increased accountability on the employee for successful completion. Larger employers report programs for new graduates that rotate new employees through the organization over a year in some technical disciplines (e.g., engineering). However, smaller companies report fewer formal programs. Employers in the industry report formal programs in place to support apprenticeship training in the traditional trades. Many employers reported tuition reimbursement programs for employees subject to validation of the relevance of the program and prior approval.

For the drilling and services sector, the nature of the development of new employees requires ongoing training (either in-house or in the field) during the working season, in addition to outsourced specific technical or safety training.

Aside from targeted technical training or mandatory training, companies focus on providing leadership development courses. These are most commonly provided by external sources through customized in-house training. Another key observation is the degree to which most companies report that training is outsourced — as high as 100 per cent in some cases. A theme that emerges from the data is that companies report insufficient staff to provide training in-house.

Canadian credentials are well recognized on an international basis. The Association of Professional Engineers, Geologists and Geophysicists of Alberta (APEGGA) recognizes the engineering status of workers from other Canadian jurisdictions and the United States, and reviews the credentials of engineers from other countries on a demand basis. Canadian drilling courses are recognized abroad, particularly in the United States.

Skilled immigrant workers (e.g., engineers from Latin America, Middle East) must requalify in Canada. The requalification process reviews experience and recognition of the formal

education training standards in the country of origin. It is reported that most immigrants are unaware that their credentials will not be automatically accepted in Canada until they apply for membership and certification. In fact, a major issue for new engineer or geologist immigrants is the serious misconception that they are immediately employable. Although prior assessment from the Canadian Council of Professional Engineers (CCPE) is available (for academic assessment only), many new immigrants fail to recognize that it may be years before they are requalified in Canada. Further, there are no programs in place that target upgrading their education to Canadian standards, and many immigrants report that they would have to “start over”. Analyses of the foreign worker exemption data indicate that most foreign workers in the engineering and technology disciplines are from the United States or Europe. The issue of recognition of credentials for immigrants from these areas is not as significant, as many of the academic institutions they have attended are recognized on the Foreign Degree list from the CCPE.

### Gender Enrolment Analysis

The following chart presents a breakdown by gender for the top college fields of study with the highest enrolment numbers.

<b>TOP COLLEGE PROGRAM ENROLMENTS IN CANADA BY GENDER (1999-2000)</b>				
<b>Program</b>	<b>Enrolment by Gender (% of Total)</b>			
	<b>Female</b>	<b>Male</b>	<b>Not Specified</b>	<b>Total</b>
Arts and sciences	89,724 (59.1%)	62,221 (40.9%)	2 (0%)	151,947 (100%)
Other mechanical engineering technology	465 (6.6%)	6,598 (93.2%)	13 (0.2%)	7,076 (100%)
Data processing	1,184 (34.5%)	2,234 (65.1%)	16 (0.5%)	3,434 (100%)
Civil technology	466 (14.7%)	2,691 (85.0%)	10 (0.3%)	3,167 (100%)
Environmental control/protection technology	1,205 (44.4%)	1,487 (54.7%)	24 (0.9%)	2,716 (100%)
Chemical engineering technology	969 (52.5%)	867 (47.0%)	8 (0.4%)	1,844 (100%)
Engineering design/drafting	303 (24%)	946 (75%)	12 (1.0%)	1,261 (100%)
Other industrial engineering technology	165 (15.2%)	907 (83.7%)	11 (1.1%)	1,083 (100%)
Machinist	39 (4%)	937 (95%)	10 (1.0%)	986 (100%)
Other engineering general	172 (18.5%)	746 (80.3%)	11 (1.2%)	929 (100%)
Results represent totals (part-time and full-time enrolments) from all provinces.				
Source: Statistics Canada.				

The following chart presents a breakdown by gender for the top trades fields of study with the highest enrolment numbers.

<b>TOP TRADES AND TECHNOLOGY PROGRAM ENROLMENTS IN CANADA BY GENDER (1999-2000)</b>				
<b>Program</b>	<b>Enrolment by Gender (% of Total)</b>			
	<b>Female</b>	<b>Male</b>	<b>Not Specified</b>	<b>Total</b>
Heavy equipment mechanics	179 (2.3%)	7,446 (94.8%)	228 (2.9%)	7,853 (100%)
Welding technology	401 (5.8%)	6,408 (93.2%)	68 (1.0%)	6,877 (100%)
Industrial design/operations technology	402 (11.6%)	3,019 (87.2%)	43 (1.2%)	3,464 (100%)
Machinist	86 (5.2%)	1,345 (82.0%)	209 (12.8%)	1,640 (100%)
Other mechanical engineering technology	52 (5.1%)	825 (81.1%)	140 (13.8%)	1,017 (100%)
Data processing	199 (23.4%)	614 (72.1%)	39 (4.6%)	852 (100%)
Heat/insulation	28 (3.6%)	750 (96.4%)	0 (0%)	778 (100%)
Instrumentation	11 (2.3%)	476 (97.7%)	0 (0%)	487 (100%)
Repair and services	9 (2.2%)	254 (62.3%)	145 (35.5%)	408 (100%)
Results represent totals (part-time and full-time enrolments) from all provinces				
Source: Statistics Canada.				

The participation by women in trades and technology remains low in the traditional oil and gas occupations.

### The North

The trend towards increasingly higher levels of essential employability skills means that the focus of education, training and development programs in the North is not just on technical skills but also on filling in educational gaps that permit access to higher levels of technical training. The opportunity for significant permanent work experience in oil and gas has yet to occur. The language and literacy skills of worker supply pools the industry would target for employment are a barrier. Some E&P companies, as well as service companies, have provided direct investments in literacy programs at the individual school level to assist in overcoming this barrier.

The Government of the Northwest Territories sponsors Aboriginal employment enhancement through many programs. The majority of education, training and development initiatives in the Northwest Territories are partnerships between governments, the local communities, local businesses and the development companies. Oil and gas companies currently spend approximately \$2 million per year on education, training and development in the Northwest Territories, much of which is provided “in kind” through donations of time, equipment and facilities.

## **Oil Sands**

The pattern of education, training and development in the Oil Sands sector has closely followed the development of that sector. Initially, the major mining companies focused on in-house programs. As the industry developed and more operators and service companies joined the sector, the trend became one of collaborating with the local college to share costs and keep the training infrastructure up-to-date. While some of the technical training (e.g., common safety training programs) has been outsourced by the mining operators, each of the companies still provides in-house training on the softer skills.

A key issue in education, training and development in the Wood Buffalo region is that the Oil Sands industry has attracted some potential workers who are drawn by the lure of high-paying industry jobs but may find that they are disqualified as a result of insufficient educational attainment levels. For many job seekers, the cost of foregoing employment to complete high school in a high cost-of-living environment results in higher drop-out rates. Convincing people to complete high school or other pre-training is a significant issue, especially given the lower educational attainment levels relative to the rest of the province or territory.

The same issues apply to the Aboriginal communities where Aboriginal Peoples who want to attend college, or even high school, must generally relocate from their home communities to Fort McMurray. The cost of providing higher levels of education, including high school, to smaller isolated communities is often prohibitive.

## **WCSB**

There has been a trend in the WCSB for companies to rely more heavily on third-party providers for education, training and development. In many cases, these are publicly funded institutions. The WCSB is served by a large number of education providers in Alberta, western Canada, and the rest of Canada.

There has been an increase in the participation rates of women in the technical and scientific programs of Calgary-based education institutions as well as the training programs specifically geared to the oil and gas industry.

Government regulation has been a key driver in the development of trades and competency-based training programs as well as safety and environmental training that is part of technical preparation for work in the oil and gas industry. Regulation has had less impact on degree programs and technology programs leading to diplomas.

The cyclical nature of the oil and gas industry, combined with broader restructuring in recent years, has sometimes caused a lag between demand for certain workers and their graduation from relevant programs. In the extreme case of four-year degree programs, it can take up to three years before supply of new graduates adjusts to a change in demand. In the case of a reduction in demand, new graduates are often competing with experienced workers for a limited number of positions. Under these circumstances, many new graduates leave the industry, in some cases permanently.

## East Coast

The education, training and development providers on the East Coast are reported to provide a high standard of excellence in the development of new candidates for the oil and gas industry.

Major issues identified in the East Coast include the inability to plan strategically for the industry due to the erratic nature of growth predictions. The impact on the educational institutions is to make forecasting numbers of graduates required, programs required, and new programs difficult to assess. The education, training and development model is generally responsive to the needs of industry in providing the formal training required for the oil and gas industry.

The colleges, universities and institutes provide a substantial training ground for the upstream oil and gas industry with petroleum programs at the bachelors, diploma and certificate levels.

## Central Canada

Although central Canada is not a significant upstream oil and gas region, it does contribute significantly to the supply of skilled labour utilized by the industry. Central Canada supplies graduates in engineering, geosciences, environmental sciences and technical and technology programs. According to Statistics Canada in 1998, central Canadian universities, colleges and institutes trained approximately 68 per cent of total undergraduates and graduate students.

## Trends

There are some key emerging trends in the industry that are consistently reported both through focus groups with the training providers and employees, and the responses to the human resources practices survey. These trends are summarized below:

- **E-learning, computer-based training and self-study** are the preferred method of delivery for training. Technical training curriculum and soft skill training programs are now being delivered online. As more employees gain access to technology, the use of e-learning environments becomes more prevalent. On East Coast offshore facilities, where employees are on the facility “24/7”, the use of this technology permits employees to use their time effectively for skills upgrading, soft skills training and formal education programs. Overcoming the technology barriers requires employers to invest in the technical infrastructure to support Internet and online programs;
- **Technology skills** – the importance of technology skills essentially spans all positions in the upstream oil and gas industry across all sectors. Many companies reported that technology was a key focus for their competitive strategy. Overall, increased use of technology is expected to change the nature of many jobs within the industry. In most cases, the job itself will not change. Rather, the way in which the job is undertaken may evolve. For example, the gathering of production data at well sites will likely become more automated.



- The skills of the field operators will therefore evolve to include the ability to use and diagnose the remote monitoring equipment. The basic skill of interpreting seismic data will not change but the tools available to support this work will continue to evolve and become more sophisticated and powerful. Awareness of how technology is shaping the nature of their jobs will be essential for a majority of employees in the upstream oil and gas industry;
- **Interpersonal/problem solving and leadership skills** – these skill sets, which include leadership, problem solving, communications, team orientation and decision-making are considered significant to the industry as the workforce ages and the need for transitioning responsibility to younger workers becomes important. Demographic pressures amplify the need for mentoring skills within the older workforce, while the younger workforce learns management skills. Communication skills are essential in the highly technical oil and gas industry and critical to project management – a skill that is in increasing demand as the industry focuses on non-conventional activities. In addition, as the industry’s workforce becomes more diversified and operations expand into more remote and diverse communities an understanding of diversity will be very important. Almost all companies with formal training and development programs (i.e., the larger companies) indicated that interpersonal/problem solving skills were an integral and increasingly important element of their overall employee development objectives;
- **Cross-functional skills** – these skills enable employees to perform in more than one functional area of the organization. They may include more than one professional skill area (i.e., geology and business acumen) or dual trades (i.e., millwright and welder). The value of cross-functional skills in the labour force is flexibility and versatility for the employer and mobility and employability for the employee. While many organizations report that cross-functional skills are considered to be desirable, the vast majority of employees are focused on a single functional area. Many of the organizations surveyed reported a desire to provide employees with exposure to different functional areas over their career but this was not seen as formal cross training;
- Since the nature of the work in the oil and gas industry often calls for **multi-disciplinary skills**, the use of multi-disciplinary teams is prevalent in the industry. For example, exploration teams often bring together geologists, reservoir engineers, landmen and supporting technicians to efficiently exploit the resources in a specific geographic area. While the desire to have individuals with multiple skills was expressed, the majority of study participants indicated that use of multi-disciplinary teams was likely to continue for the foreseeable future, especially as individual roles become more complex;
- **Business skills** – business literacy (or acumen) has become increasingly critical to operating in a more challenging economic environment for the industry. Business literacy is the understanding of how economic forces are affecting the operations of the industry as well as the financial skills to establish or understand sophisticated budgets and other financial instruments that facilitate the management of the business. Enhanced development of business literacy, supported by decision-making skills, has been identified by participants as a future key competency that will be a priority area for training and development programs;
- The advent of **demonstrating competencies** to meet existing regulatory requirements will increase the focus of employers and employees towards a competency based framework; and

- Research completed by Human Resource Development Canada and echoed in the research for this study, identified **nine “essential skills”** required by all workers to enhance their ability to competently perform their work duties. They are:
  - reading text;
  - document use;
  - writing;
  - numeracy;
  - oral communications;
  - thinking skills;
  - working with others;
  - computer use; and
  - continuous learning.

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Change Number: 3  
Last Saved On: 7/24/2005 3:02 PM  
Last Saved By: LP PC  
Total Editing Time: 14 Minutes  
Last Printed On: 7/24/2005 3:04 PM  
As of Last Complete Printing  
Number of Pages: 147  
Number of Words: 49,180 (approx.)  
Number of Characters: 280,329 (approx.)