# Industrial Development in British Columbia's Offshore Oil and Gas Industry

## PRELIMINARY ANALYSIS

BC INNOVATION COUNCIL

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# EXECUTIVE SUMMARY

The experience in such places as Norway, Nova Scotia and Newfoundland and Labrador shows that offshore petroleum activity can make a major contribution to economic development. Local companies have been able capture a significant share of supply and service work, leading to success in export markets and other industrial sectors. Companies and institutions have also been able to capture offshore petroleum research and development (R&D) activity, leading to the development of niche technologies and capabilities that have then been sold in local and international markets. As such, offshore petroleum activity can be a powerful engine for the economic expansion and diversification.

The Government of British Columbia has initiated a process for ensuring that the province maximizes the potential benefits from offshore petroleum activity. To assist in the development of an appropriate industrial development strategy for BC, the Innovation and Science Council of British Columbia (ISCBC) contracted this preliminary analysis. It reviews the likely timing, duration and the direct industrial requirements of each of the main phases of offshore activity. It then discusses the opportunities for harnessing offshore petroleum activity to BC's industrial development, and the approaches that might be used in achieving same, and proposes an offshore petroleum industrial development planning process.

In any one region, there is a sequence of activities or phases (pre-exploration, exploration, development and production) that overlap with time. The speed with which each happens depends on such factors as technological challenges, oil and gas prices, jurisdictional issues, regulatory requirements, government support, and exploration success. In British Columbia, development activity is not expected to start until between 2009 and 2015, and production until between 2017 and 2020, at the earliest. Accordingly, this study focuses on pre-exploration and exploration, which will occur in a timeframe during which the nature of the industrial opportunities is reasonable certain. By the time development activity starts technologies and business practices will likely have greatly changed. Furthermore, if there are poor exploration results, such activity may never occur.

In seeking to maximize the industrial benefits from offshore petroleum activity, the opportunities associated with providing supplies and services should be differentiated from those related to R&D. While there will be some overlap, the nature of the opportunities and appropriate responses differs. In the former case, each phase of activity has different supplies and services requirements, although some are common to two or more phases. Highly specialized global companies undertake some work, such as the core tasks associated with seismic surveys and drilling. However, many other supplies and services are commonly contracted from local companies. Some BC companies already provide goods and services to the offshore and onshore activity outside the province, and to onshore work in the North East of the province. However, while these firms will likely benefit from local offshore activity, in the next few years it will only provide pre-exploration and exploration-related

opportunities. Furthermore, there is only a limited transferability of expertise and equipment from onshore to offshore activity; the latter is more capital intensive and commonly uses different technologies, expertise and business practices.

Because of these characteristics of the offshore petroleum industry, it presents R&D opportunities. Their potential is illustrated by the experience of Norway, the UK and Atlantic Canada, which have been able to capture such work to the benefit of local research institutions and companies.

In seeking to benefit from these supply and service and R&D opportunities, it is important to use approaches that: build on existing local strengths; respond to the particular challenges the province presents to offshore petroleum activity; seek to diversify the economy; emphasize quality; and, undertake effective planning to benefit from petroleum industry activities.

Build on Existing Strengths: The best basis for building supply and service and R&D capabilities is BC's current industrial strengths and capabilities. It is always easier to channel and benefit from existing abilities, than to introduce new ones. Furthermore, this approach helps to counter the uncertainty associated with offshore petroleum activity, because newly developed capabilities will likely also have applications in other sectors.

Respond to Local Challenges: Attempts to develop supplies and services and R&D should focus on the challenges in the local operating environment. In both Europe and North America, capabilities and products developed in response to such challenges have become niche specialties sold in other parts of the world and other industries.

Diversify the Economy: Offshore petroleum activity should be used to diversify the economy of BC, by both providing a new sector and providing businesses and the economy as a whole access to new local, national and international markets. This is again important because of uncertainty about the presence and scale of offshore petroleum activity in BC.

Emphasize Quality: Health, safety, environment and quality are very important to the oil industry, with almost all companies being required to have very high quality expertise and equipment. While this is a constraint and challenge to companies wishing to secure contracts, those that succeed will become competitive in this industry in BC and beyond, and in other industries.

Plan Effectively to Benefit from Industry Activities: Industrial development strategies should also be integrated with local benefits plans and processes, including government regulatory requirements and programs, and oil company community contribution and benefits planning initiatives.

In order to make the most of these industrial development opportunities, separate supplies and services and R&D initiatives are required. Supplies and services opportunities should be explored and pursued through four staged initiatives:

- Review of Petroleum Industry Supplies and Services Requirements;
- Review of BC Supplies and Services Capabilities;
- Supply and Services Gap Analysis; and
- Supply and Services Plan Development.

Similarly, the R&D opportunities should be examined and pursued through a:

- Review of R&D Requirements;
- Review of BC R&D Capabilities, Aspirations and Plans;
- Establish R&D Opportunities, Priorities and Related Requirements; and
- R&D Plan Development.

A government agency or industry association, using a multi-stakeholder management committee, should manage the plan development process. Given the long-term requirement to oversee the plans and monitor their effectiveness, there would also be merit in establishing an overall BC offshore petroleum committee or council to oversee the program in the broader context of the province's industrial benefits and economic development goals. The plan development process will take about 14 months and should be initiated as soon as possible; some pre-exploration opportunities will arise soon after the moratoria are lifted, and plans should be in place to benefit from them.

# TABLE OF CONTENTS

**Page No.**

## FIGURE



## TABLES



## APPENDIX

# 1.0 INTRODUCTION

## 1.1 Background and Purpose

In 2001, the Province of British Columbia began a review of the provincial moratorium on offshore petroleum activity. As the lead coordinating agency for petroleum resources off the coast of British Columbia (BC), the Ministry of Energy and Mines commissioned three reports on the engineering, science and socio-economic aspects of offshore oil and gas activity:

- British Columbia Offshore Oil and Gas Technology Update (Jacques Whitford, 2001);
- Report of the Scientific Review Panel on British Columbia Offshore Hydrocarbon Development (Strong, Gallagher and Muggeridge, 2002); and
- Report of the Offshore Oil and Gas Task Force (2002).

The reviews found no inherent or fundamental deficiencies in the scientific or engineering knowledge base that would rule out offshore petroleum exploration and development activities in coastal BC. However, 15 recommendations addressing scientific, design, socio-economic and regulatory issues were put forward in the *Report of the Scientific Review Panel on British Columbia Offshore Hydrocarbon Development.* In response to Recommendation 12 (Coastal Community Development Strategy), the Province of British Columbia has initiated the preliminary planning steps for the development of an industry development strategy for offshore petroleum activity.

To assist in the development of the offshore petroleum strategy for BC, the Innovation and Science Council of British Columbia (ISCBC) has contracted this initial industrial development study. It establishes the likely timing and duration of the main phases of offshore activity, and the likely direct industrial requirements during each of them. It also reviews the opportunities for harnessing offshore petroleum activity to BC industrial development, and discusses the approaches that might be used to do so, leading to the presentation of a recommended offshore petroleum industrial development planning process. The focus throughout is the opportunities for BC-based companies to be involved in the provision of goods and services to offshore activity, and on the potential for BC involvement in offshore petroleum-related research and development activity.

## 1.2 Report Structure

The next section of this report seeks to establish the likely timing and duration of the main phases of activity: exploration, development and production, as well as the pre-exploration period during which jurisdictional arrangements and regulatory regime are established, leading to the issuance of exploration licenses. Section 3.0 then describes the likely direct industrial requirements during each of these phases, focusing on the ability of industry in BC to provide them. This is followed, in Section 4.0, by discussion of the opportunities for harnessing offshore petroleum activity to BC

industrial development, and the approaches that might be used to do so. Based on this, Section 5.0 outlines a recommended offshore petroleum industrial development planning process, leading to the implementation of a Supply and Services Plan and an R&D Plan.

## 2.0 TIMELINE FOR OFFSHORE INDUSTRY ACTIVITIES IN BC

In any one region, offshore petroleum activity sees a sequence of phases of activity (pre-exploration, exploration, development (construction) and production (operations)) that may overlap with time. Each phase of has different supplies and services requirements, although some are common to two or more phases. Accordingly, it is important to have a clear picture of the likely pace of development of activity and hence industrial opportunities, as well as the timeframe for planning for local involvement.

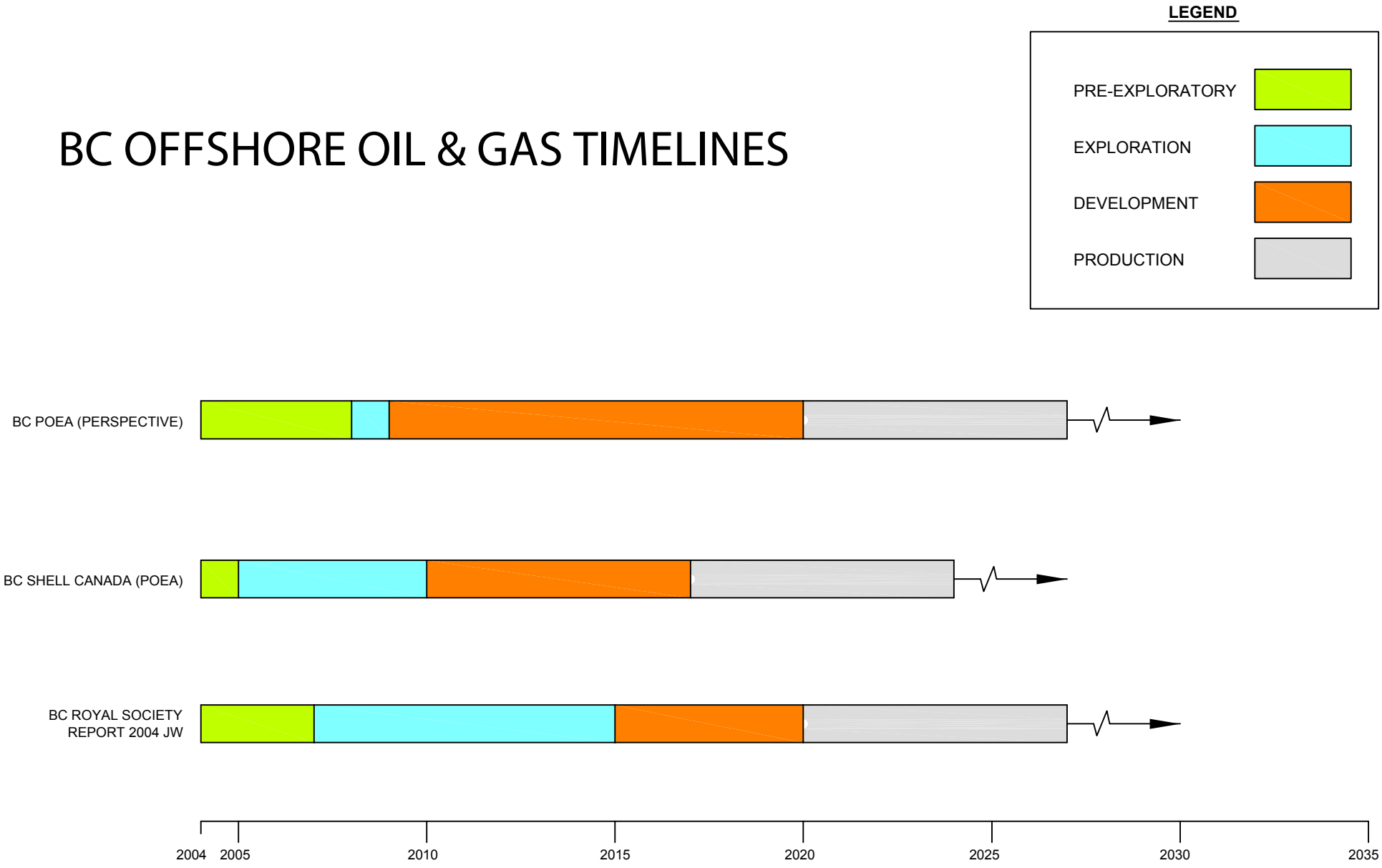
A number of groups and agencies have estimated timelines for BC offshore petroleum activity (see Figure 1). While some are general, others are very detailed, with that provided in the report of The Royal Society of Canada (2004) being an example of the latter.

All offshore petroleum activity development timelines are, by nature, very speculative. The actual pace of development in any region is affected by such factors as:

- technological challenges and innovation;
- oil and gas prices;
- jurisdictional issues;
- regulatory process requirements;
- the availability of government support;
- exploration success; and
- the local biophysical and socio-economic setting.

For example, offshore petroleum activity in the Newfoundland and Labrador commenced with the issuance of exploration permits in 1963. The first exploration well was drilled in 1966, but a number of issues slowed the development of the industry. The first commercial field, Hibernia, was not discovered until 1979, development of it did not commence until 1990, and production did not begin until 1997. This 34-year timeline from the start of exploration to production is an example of a case where technological challenges, disputes over jurisdiction (at different times the region has seen disputes between the federal and provincial governments, Canada and France, and Newfoundland and Labrador and Nova Scotia), fluctuating resource prices, and the commercial problems of oil companies contributed to a very slow development of the industry.

# BC OFFSHORE OIL & GAS TIMELINES

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OFFSHORE OIL & GAS TIMELINES

FIGURE
1

This study of industrial development opportunities in BC focuses on pre-exploration and exploration activity. There are two reasons for this. First, there is the greatest certainty that such activity will occur, in that it is always possible that exploration will lead to a conclusion that the region does not contain commercial reserves. Second, these phases will occur in a timeframe during which the nature of the industrial opportunities is reasonable certain. For example, the most optimistic scenarios do not see production starting until 2017. This is too far in the future for there to be a current understanding of the nature of the requirements associated with production or how appropriately to respond, given that the technologies and business practices involved will likely have changed greatly by then. To a lesser degree, the same is true of the first development activity, given the rapid pace of innovation that characterizes this industry.

For these reasons, it is appropriate to concentrate attention, especially when it comes to the opportunities for BC companies, on pre-exploration and exploration. However, as is discussed below, it is also important that the business community and government continue to monitor developments in all phases and aspects of the industry, so as to understand emerging opportunities and associated requirements and timelines, and plan appropriately.

## 2.1 Pre-Exploration

Pre-exploration activities include learning about the industry, collecting baseline environmental data, conducting strategic environmental assessments, establishing jurisdictional arrangements (including resolving land claims) and a regulatory regime, and establishing and issuing leases (Campbell *et. al.*, 2002a; PricewaterhouseCoopers, 2001; Royal Society, 2004; Strategic Concepts *et. al*., 1999).

The estimates of duration of pre-exploratory activities (Table 1) range from one year, in a Shell Canada presentation (Collyer, 2003) that only included baseline regional studies, to a Pacific Offshore Energy Association (POEA) estimate of four years.

**Table 1 Estimates for Pre-Exploration Activities**

| Source | Activity | Time Frame |
|---|---|---|
| Analysis of Potential Services to the BC Offshore Oil & Gas Industry | Canada/BC/First Nations regulatory regime established | 2 years |
| | Environmental assessments conducted (re seismic and exploratory drilling) | 1 year |
| | Establish new leases | 1 year |
| POEA | First Nations land claims interests | 2 years (2004 – 2006) |
| | Policy objectives between the provincial and federal governments | |
| | Jurisdictional issues resolved (provincial/federal/ municipal) | 4 years (2004 – 2008) |
| | Fiscal regime/revenue sharing agreements | |
| | Regional benefits outlined | |
| | Rights, leases, tenure agreements/regulations | |
| | Operational regulations created | |
| | Environmental Assessment/Monitoring regulations created | |
| Royal Society of Canada Expert Panel | Land claims issues and ownership of offshore resources settled | 3 years (2004 – 2007) |
| | Regulatory regime established | |
| | Strategic environmental assessments conducted | |
| | Environmental impact assessments (for seismic surveys) completed | 1 year (2007-2008) |
| Shell Canada | Base studies conducted | 1 - 1 ½ years |

It is important to note that these timelines do not all include the same activities for each phase. For example, the Shell forecast does not specifically include the need to settle jurisdiction and land claims, and establish the regulatory regime and lease arrangements. For this reason, the different timelines are not directly comparable for this or the other phases.

## 2.2 Exploration

Exploration activities include environmental assessments for seismic and exploration drilling programs, two-dimensional (2D) and three-dimensional (3D) seismic surveys, seismic interpretation, and exploratory and delineation drilling (Campbell *et. al.* 2002a; PricewaterhouseCoopers, 2001; Royal Society, 2004). It should be noted that getting regulatory approvals and interpreting exploration results takes much more time than the actual seismic surveys and drilling of wells.

The different timelines estimate that the initial exploration activity (i.e., prior to any development activity; it should be remembered that exploration will continue through most of the life of any producing region) will last three to seven years (Table 2). This is consistent with the pattern in other parts of the world; it is still the case that only one in eight or ten exploration wells discovers hydrocarbons, and that there is a periodic need to review, interpret and perhaps re-interpret exploration results before planning further exploration.

**Table 2 Exploration Phase Timelines**

| Source | Activity | Time Frame |
|---|---|---|
| Analysis of Potential Services to the BC Offshore Oil & Gas Industry | Seismic surveys | 1 year |
| | Planning drilling programs | 1 year |
| | Exploratory drilling | 1-2 years |
| Royal Society of Canada Expert Panel | 2D seismic surveys conducted | 1 year (2008 - 2009) |
| | 3D seismic surveys conducted | 1 year (2010 - 2011) |
| | Environmental assessments conducted for drilling activities | 1 year (2011 - 2012) |
| | Exploration drilling | 2 years (2012 – 2014) |
| | Delineation drilling | 2 years (2013 – 2015) |
| Shell Canada | 2D seismic surveys | 1 year |
| | 3D seismic surveys planning | 1 year |
| | 3D seismic surveys | 1 year |
| | Seismic interpretation | 1 year |
| | Exploration drilling | 1 year |
| | Delineation drilling | 1 year |

## 2.3 Development

Once a commercial field has been identified, development activities can proceed. They include getting regulatory approval for production activity, planning the development of the field, analyzing and selecting drilling prospects, obtaining permits and approvals, constructing and installing production and transportation systems, and drilling production wells (Campbell *et. al.* 2002a; PricewaterhouseCoopers, 1999; Royal Society, 2004). There is, generally speaking, no difference between the time needed to develop oil and gas fields.

Production systems vary depending on factors specific to the field and its setting. Historically, they have mostly used steel or concrete platforms anchored to the sea floor. However, the past decade has seen an increasing use of floating and subsea systems, with the former including Floating Production Storage and Offloading (FPSO) vessels and tension leg and spar platforms. The choice of production systems for BC fields will depend on such things as water depths, environmental conditions, the characteristics of the oil and/or gas, and the size of the field.

The transportation of hydrocarbons to shore is accomplished using tankers and/or pipelines. The mode used for any BC field will again depend on a number of factors, including its location, the characteristics of the oil and/or gas, the seabed topography and geology, and the ease of access to the

North American pipeline system. There may be a need for an onshore transshipment facility, pipeline landfalls, and other onshore infrastructure.

The estimates of the time required for developing an initial field range from five to seven years (Table 3), although the POEA report did not provide a timeline for the development phase other than to indicate that production might not begin until 2020.

**Table 3 Development Phase Timelines**

| Source | Activity | Time Frame |
|---|---|---|
| Analysis of Potential Services to the BC Offshore Oil & Gas Industry | Development planning and environmental impact assessments | 2-3 years |
| | Development activity | 3-4 years |
| Royal Society of Canada Expert Panel | Environmental impact assessments conducted | 2 years (2014 – 2016) |
| | Development planning; approvals, construction | 3 years (2016 – 2019) |
| Shell Canada | Development planning (approvals, financing, *etc.*) | 3 years |
| | Development (facility construction/installation, production well drilling, other infrastructure) | 2 years |

## 2.4 Production

Production involves extracting and transporting hydrocarbons, developing and monitoring production, operating facilities, and evaluating reservoir performance (PricewaterhouseCoopers, nd). Production from any one field usually lasts from 10 to 25 years, depending on the size, extraction rates and petroleum prices (Campbell *et. al.*, 2002a). However, all producing basins contain multiple fields and pools that are slowly discovered and developed over time. For example, while offshore production in the Gulf of Mexico first started in the 1930s, the region is still seeing exploration and the development of new fields.

In the past, large fields like Brent and Ekofisk would have been produced using more than one production platform. With advances in technology, one production system has become the norm for all sizes of field. Furthermore, it is increasingly common for smaller satellite fields or pools to be linked to an existing platform as production from the original field declines, so as to make the most of production and transportation capacity already in place. In these cases, one platform may end up producing two or more fields.

# 3.0 INDUSTRIAL REQUIREMENTS

Each phase of offshore petroleum activity, and the pre-exploratory period, has differing supplies and services requirements. Pricewaterhouse-Coopers (2001) has identified over 400 such services and supplies (referred to as value chain categories) which are required by the offshore petroleum industry in Atlantic Canada during the various phases of activity. Campbell *et. al.* (2002b) identifies 266 supply and service categories under the headings: marine industry, environmental consultants, and oil and gas services and supplies.

This section reviews these requirements, focusing on the likely direct industrial requirements related to offshore petroleum activity and on the ability of industry in BC to provide them.

## 3.1 Pre-Exploration

As was described above, Section 2.1, the pre-exploration period establishes the framework and basis for offshore petroleum activity. The main types of services that are required and might be supplied locally are shown in Table 4 (Campbell *et. al.*, 2002a; PricewaterhouseCoopers, 2001; Royal Society, 204; Strategic Concepts *et. al*., 1999).

**Table 4 Pre-Exploration Supply and Service Opportunities**

| **Pre-exploration Support** | |
|---|---|
| Baseline studies | Environmental permitting |
| Strategic environmental assessments | Environmental services |
| Legal services | |

The duration of pre-exploratory opportunities is particularly uncertain, but likely relatively short (*i.e.* 1 to 4 years), limiting the opportunities for the involvement of local companies in areas beyond their existing capabilities.

## 3.2 Exploration

Offshore seismic surveys and exploration drilling are undertaken by a relatively small number of highly specialized global companies. However, a large range of exploration services may be out-sourced to local companies (see Table 5) (Strategic Concepts, 1999; Campbell *et. al.*, 2002a).

**Table 5 Exploration Supplies and Services**

| **Exploration Support** | |
|---|---|
| Drilling rigs | Mud logging |
| Supply vessels/chase vessels | Coring |
| Helicopter services | Solid controls |
| Shore base | Offshore communications |
| Well testing | Drilling tools/drill bits |
| Wireline logging | Mud logging |
| Cementing | Weather forecasting |
| Drilling fluids | Sampling services |
| Wellheads | Core analysis |
| Directional drilling | ROV services |
| Crewing services | Pilots (ships) |
| Customs brokerage/consulting | Positioning services |
| Fisheries consultants | Stevedores |
| Fuel supply | Ship chandlers |
| Garbage disposal | Ship agents |
| Hotels | Trucking and craneage |
| Immigration consulting | Transportation – air/ground |
| Life-raft servicing | Warehousing/Freight Forwarding |
| Linesmen | Waste oil disposal |
| Materials and equipment | Tubular supplies |
| Bonded services | Diving and diving support |
| Catering | Environmental/safety services |
| Cleaning | Insurance |
| Cementing, acidising and fracturing services | Machine shop services |
| Mud supply | Non-destructive testing/inspection |
| Oceanographic monitoring | Rig positioning and site surveying |
| Survival training | Equipment rental |
| Marine medical | |

In general, exploration programs are of short duration and there is significant uncertainty in the scale of activity. A typical seismic program lasts from two to three months. The duration of an exploratory drilling program is dependent on a number of factors including the number and depths of wells. Drilling a well typically takes ten to fifteen weeks and, depending on the success of the program, drilling can occur over a period of years a commercial field is discovered. However, as is discussed below, it is quite common for such drilling to be discontinuous.

Offshore exploration activity requires a supply base that must be able to provide: berthing for supply vessels; dock space for materials, pipe and container handling and storage; storage facilities for drilling fluids; fuel; water; and warehousing. These must be secure and available around the clock. A heliport near the supply base, and good transportation connections to the outside world, are also very desirable.

As part of the mobilization for exploration drilling, there is commonly a need to upgrade or modify rigs entering Canada, in order that they meet Canadian Coastguard and Transport Canada requirements. This may entail modification, enhancement or maintenance activities and can provide a significant business for local shipyards and related suppliers of equipment and services (Campbell *et. al.*, 2002a). While these opportunities are again short-term and transitory, they can provide valuable additional business for existing marine sector companies.

The presence and pace of exploration is highly dependent on factors such as oil and gas prices, exploratory success, and exploration prospects elsewhere. If the local outlook is unfavourable the exploration will cease and the equipment and crew will move to another part of the world or be demobilized. Local industry opportunities are, therefore, usually modest, short term and unpredictable (Campbell *et. al.*, 2002a). Furthermore, exploration generally provides fewer and smaller industrial opportunities than do the development and production phases of offshore activity; the major benefit from exploration activities is the value derived from providing the base for future development and production activities (Strategic Concepts, 1999).

## 3.3 Development

The development of an offshore oil or gas field requires many of the same supplies and services as are needed for exploration (Section 3.2), including those associated with drilling wells. Additionally, development supplies and services include the engineering, design, construction, fabrication and installation of production and transportation systems, including pipelines, flowlines, and subsea production equipment. Other supplies and services relate to development well drilling, procurement, project management, and production and process equipment (Strategic Concepts, 1999). (Table 6)

**Table 6 Development Supplies and Services**

| **Development Support** | |
|---|---|
| Construction/fabrication (production systems, specialized equipment) | Construction/installation of transportation systems |
| Engineering/design | Commissioning/Maintenance of offshore rigs |
| Specialized tug design/construction | Construction/installation/commissioning of platform components |

Development commonly involves construction activity that may be of large scale and located close to the field. Such construction work occurs sporadically, is of relatively short duration, and can result in a boom and bust of demand for local goods, services and labour. However, the increasing use of floating and subsea production systems that are produced in such places as South Korea and Italy has reduced local industrial opportunities. For example, no Canadian shipyard is capable of constructing an FPSO hull, whereas South Korea companies build them on a production line with great efficiency

and at low cost. As a result, the major local opportunity associated with such vessels is the construction, installation, commissioning of topsides and other production and transportation systems.

## 3.4 Production

Production activity requirements include a number of the supplies and services already noted for the exploration and development phases, and in particular those indicated in Table 7. (Strategic Concepts, 1999, Community Resource Services, 2003)

**Table 7 Production Supplies and Services**

| **Production Support** | |
|---|---|
| Support vessels | Operations services |
| Engineering services | Helicopter services |
| Drilling services and supplies | Transportation/communication services |
| Shuttle tankers | Inspection/maintenance/repair/fabrication services |
| Onshore supplies and services | Catering, materials and support services |
| Welding capabilities to manufacture tanks, silos and other steel components | Hyperbaric pressure testing |
| Environmental effects bio-monitoring | Area and route forecasting |
| Electrical instrumentation | Manifold and template fabrication |
| Legal services | Remote occupational nursing |

Production activity lasts for a long time, permitting companies a return on investment that may justify significant investments in equipment and expertise. It is also a substantial consumer of supplies and services. For these reasons, of the different phases of activity, it is production that provides the greatest potential for local industry. However, given the likely timeframe for first production in BC, combined with the fast pace of technological change in the offshore petroleum industry, it is not currently possible to properly identify and plan for specific local opportunities. However, by preparing for, and building upon, the expertise, skills and experience gained through pre-exploration, exploration and development activity, local capabilities will be in place and ready to meet many of the requirements of production when required (Strategic Concepts, 1999).

# 4.0 INDUSTRIAL BENEFITS OPPORTUNITIES, APPROACHES AND STRATEGIES

This section of the report discusses the opportunities, approaches and strategies that might be used to harness offshore petroleum activity to BC industrial development. It primarily draws on experience and developments in BC, Europe and Atlantic Canada. The last is particularly relevant, compared with such other jurisdictions as the US, UK, Norway and Australia, given the likely similarities of context. These include, for example, the general business climate and the likely regulatory, legal and fiscal arrangements. The arrangements adopted in BC will in all likelihood be modeled on those established in Nova Scotia and Newfoundland and Labrador, and recent discussions as to how they could be improved.

## 4.1 Opportunities

In seeking to make the most of any offshore petroleum activity, it is important to differentiate the opportunities associated with providing supplies and services to the industry, such as have been described above, from those related to research and development (R&D). While there will be overlap in some cases, the nature of the opportunities and appropriate responses vary.

Supplies and Services: These are the opportunities to provide goods and services directly or indirectly required by the offshore petroleum industry. This includes the wide range of goods and services described above (Section 3.0). Given the likely timelines (Section 2.0), it is generally best that BC businesses concentrate on the opportunities associated with pre-exploration and exploration activity. Those associated with development and production will be many years down the road and, by that time, the industry will likely be using technologies and business practices that differ significantly from those in use today.

That said, some BC firms are already involved in all phases of onshore petroleum work in the North East of the province, and in onshore and offshore work for clients and on projects outside BC. The latter includes several physical oceanography, geo-technical, remote sensing, engineering, marine electronics, ship design, seafloor mapping, oil transportation, environmental services, diving and remotely operated vehicle services companies involved in international work (British Columbia Offshore Oil and Gas Team, 2004).

However, while the above types of firms will likely benefit from BC offshore petroleum activity, in the foreseeable future this will only provide opportunities to those seeking to secure pre-exploration and exploration-related contracts. Furthermore, there is only a limited transferability of expertise and equipment between the onshore and offshore industries. The latter involves much greater costs and work in much more challenging environments. As a result, it is more capital intensive, commonly using quite different technologies, expertise and business practices.

The experience of places like Norway and Atlantic Canada (see, for example, Community Resource Services, 2003) is that a large range of supplies and services work is commonly out-sourced to local companies, thereby delivering business and employment and diversifying the economy. Many of the companies that have become involved in the offshore petroleum industry have acquired new premises, staff, skills and capabilities, including in the areas of technology and business practices, as a result of which they have been successful not only locally, but in other markets and industries. This has been facilitated by the efforts of the local governments and industry associations, and of the oil industry.

The potential for such activity is indicated by the fact that the Norwegian offshore petroleum supply and service sector had an international turnover of 35 billion NOK in 2001. This is partly as a result of the work of Intsok – Norwegian Oil and Gas Partners, which was established in 1997 to promote the internationalization of the industry. It currently has over 100 members. (Ministry for Petroleum and Industry, 2002)

Research and Development: As was noted in the Province of British Columbia's perspective on the federal moratorium, the benefits associated with lifting it include 'expansion of BC's research and development and educational capacity' (Province of British Columbia, 2004). Offshore petroleum activity presents R&D opportunities related to exploration, development, production and transportation. This includes R&D associated with technologies related to underwater robotics, seismic interpretation, and the design of marine structures, as well as the development of 'soft' expertise, for example related to environmental and socio-economic impacts and business systems. All of these provide a good match with BC economic trends, capabilities and aspirations.

The potential of the offshore petroleum industry to contribute to R&D capacity and activity in BC is illustrated by their growth in Atlantic Canada. Significant amounts of innovative petroleum industry related R&D work is being done there, at such institutions as Memorial University of Newfoundland (MUN) and Dalhousie University and in private companies. Every year, operators, contractors, government agencies (such as the National Research Council and Department of Fisheries and Oceans, and including expenditures through the Atlantic Innovation Fund) and industry groups (such as the Canadian Association of Petroleum Producers (CAPP), Petroleum Research Atlantic Canada (PRAC), and the Environmental Studies Research Funds (ESRF)) support or participate in a broad range of studies and experiments related to oil and gas activity. This has led to the development and commercialization of technologies and services with wide application.

This includes work in such areas as:

- engineering and design (e.g., platform design, and vessel design and mooring options);
- operational studies (e.g., seismic survey techniques, vessel offloading, safety equipment and procedures, ice detection and response, and onshore/offshore communications); and
- environmental investigations (e.g., wave and current studies, beached bird surveys, and fish habitat compensation).

These activities have sustained and further built the Atlantic Canada R&D community, assisting it in serving local interests in the petroleum and other industries. Petroleum-related activities have also helped develop centres of excellence in both Newfoundland and Labrador and Nova Scotia. In the former case, for example, the province is now recognized as a centre of excellence in such areas cold oceans engineering, distance technologies and marine science.

Furthermore, offshore petroleum activity has been accompanied a significant growth in the Atlantic Canada's R&D infrastructure, some of it developed using funding from the Offshore Development Funds established to help prepare Newfoundland and Labrador and Nova Scotia to take advantage of offshore petroleum development opportunities.

Norway provides another example of the effective use of strategic approaches to the development of offshore petroleum related R&D. It has a long history of such approaches, going back to the 'goodwill agreements', a policy approach the Ministry of Oil and Energy established in 1978. Under it, oil companies were informed that they would acquire 'goodwill points' by contracting petroleum-related R&D to Norwegian research institutions; such points were necessary for the company to become a serious contender in obtaining offshore exploration and production rights. As a result of this and other initiatives, the oil and gas industry has become probably Norway's largest R&D investor, with 2000 the upstream industry expenditures of about US$150 million. It is estimated that, in 2001, about 3% of offshore technology R&D expenditures were on basic research, 76% on applied research, and the remaining 21% on technology development. About 21% were product-oriented, and 79% process-oriented.

In addition, large amounts of public funding have been spent on offshore petroleum R&D. The Norwegian Research Council (NRC) runs numerous public programs. In 2003 it spent a total of 163 million NOK on R&D, of which 47% went on strategic R&D, 36% on applied R&D, and 18% on technology demonstration programs. The NRC's main programs have included:

- RUTH (Reservoir Utilization through advanced Technological Help): Established in 1991, this is a joint initiative of the NRC, Norwegian Petroleum Directorate (NPD), 18 oil companies and several research institutes. This resulted in marked increases in petroleum recovery rates at modest cost.

- OFFSHORE 2010: This is the main R&D program for the local supply and service sector. The funding is from the upstream petroleum industry (70%) and the NRC (30%), with 65% of the work, by value, being located within industry and 35% at research institutions. The main areas covered are subsea production, drilling technologies, and well/fluid transportation technologies.

- DEMO 2000: This is a collaborative initiative which, as of 2003, involved the Ministry of Oil and Energy, four research institutes, six oil companies, and a handful of specialist suppliers. It promotes new technologies, focusing on securing new field developments through innovative and cost-effective execution models, increasing assurance that projects can be completed on schedule and within budget, and developing new Norwegian industrial products for sale in international markets (Mikkelsen et al, n.d.).

Other NRC-managed R&D programs support the DEMO 2000 initiative, which was established in 1999. These include the Petromarks research program to develop technologies to increase production from existing fields and make new reserves more accessible, and the Petropol program, which seeks to strengthen Norwegian expertise with respect to the social sciences aspects of offshore petroleum activity. (Ministry of Petroleum and Energy, 2004)

In 2003 the NRC established a series of Centres of Excellence in different academic fields, including a Centre of Excellence in Integrated Petroleum research at the University of Bergen. Its main focus is on flow phenomena in porous media, reservoir modeling and simulation, and oil recovery mechanisms. (Mikkelsen et al, n.d.)

The United Kingdom (UK) is also active in identifying and pursuing oil and gas R&D opportunities. For example, the Industry Technology Facilitator (ITF) was launched in 1999 in response to a recommendation of the Oil and Gas Industry Task Force. The Task Force, which was comprised of representatives from government, academia and industry, aimed to develop an understanding of key issues for the oil industry over the next decade. It concluded that technology leadership and cooperation were essential for the industry's future competitiveness, and recommended a cross industry body be established to stimulate technology development.

The ITF is a company that is governed by a board of oil and service company representatives. It is supported by a group of oil companies and the UK Department of Trade and Industry, with the purpose of facilitating major technological advances in the oil industry. It connects technology developers with the end users, and with sources of funding, in order to develop high quality joint industry projects that will deliver the technology to meet the needs of the industry. During 2003, ITF established 18 new joint industry projects representing an industry investment of about $10 million. (Industry Technology Facilitator, 2004)

## 4.2 Approaches

In seeking to make the most of such opportunities in BC, it is important to use approaches that build on existing local strengths and abilities, respond to the particular challenges the province presents to offshore petroleum activity, seek to diversify the economy, place an emphasis on quality, and undertake effective planning to benefit from petroleum industry programs and projects. This section of the report discusses each of these often-related topics.

### 4.2.1 Build on the Existing Strengths and Abilities

The best basis for developing the BC offshore petroleum sector is its current industrial strengths and capabilities. It is always easier to channel and benefit from existing abilities, than to try to introduce to the region ones that are largely or wholly new. Furthermore, this approach helps to counter the high degree of uncertainty associated with offshore petroleum activity, especially in its early phases, in that any new capabilities developed will likely also have current or potential application in other sectors.

The economy of BC has traditionally been largely based on harvesting and processing primary resources, such as the province's forests, minerals and fish stocks. In recent years, these industries have experienced decline, with negative consequences for the economy generally and, in particular, in the province's Northern and rural areas. However, the last decade has also seen another resource industry, onshore petroleum extraction in North Eastern BC, become increasingly important. As a result, onshore petroleum exploration and production is now the largest single natural resource generator of direct revenue to the province. The energy sector directly employs 35,000 people (Province of British Columbia, 2002, p.17), and the province is responsible for 3% of North America's natural gas production.

The geography and traditional economic base of BC has also led to the development of a number of industries of importance to offshore petroleum activity. For example, the province possesses a strong marine industry, including marine engineering, transportation, repair and sub-sea (diving and remotely operated vehicles), which present considerable possibilities in respect of offshore petroleum activity. This sector currently provides goods and services to such industries such as logging, transportation, freight handling, shipping, commercial fishing, recreational boating, piloting and shipbuilding.

Other current marine activities in BC include shipbuilding, customs brokers, marine insurers, surveying/remote sensing/mapping, underwater services, air services and shipping agents, and vessel operations such as freight and passenger water transport, marine towing, ship charters and marine salvage. The provision of services for the cruise ship industry includes major retrofits of large vessels in BC shipyards. Growing marine industries includes the development of marine technology

and research in the fields of sea floor data collection and the use of fibre optics for data collection. These developing technological capabilities have led to initiatives to build BC's ocean technology sector, including the development of an Action Framework. (Innovation and Science Council of British Columbia, 2003)

The physical geography and economy of BC have also prompted the development of a strong environmental industry offering services to all sectors. It has oil and gas experience, albeit some of it related to onshore activity in the Northeast region. Present environmental consulting services include environmental engineering, baseline studies, environmental impact assessments, socio-economic studies, policy development, environmental compliance auditing, environmental and quality management systems and geo-technical services. A number of BC environmental sector companies are involved with the offshore petroleum industry. (Offshore Oil and Gas Team, 2004)

Companies that are active in onshore petroleum activity, and the marine sector and environmental industries, are all well positioned to provide goods and services to the offshore petroleum industry. In many cases they, and BC universities and other institutions, are also involved in R&D on technologies that have current or potential application related to offshore petroleum activity, and thereby contribute to the growth of R&D activity in BC.

Research and development and high technology activity are of increasing importance in the province. The last decade has seen a diversification of the BC economy through high technology activity:

'The high technology sector has been a leading performer in BC's economy, and outperformed other sectors in revenue, employment and wage and salary growth… High-tech manufacturing industries average annual GDP growth was 11.7 percent over the last ten years, compared to 4.5 percent for high-tech service industries for the same period.' (2003 British Columbia Financial and Economic Review, BC Ministry of Finance)

In background research for the Atlantic Energy Roundtable, respondents to a consultation on offshore petroleum related industrial benefits opportunities noted the importance of being able to leverage existing local R&D to achieve world-class capability in certain niche areas. (Erlandson and PRAC, 2003, p73). The experience in other areas with offshore petroleum activity is that the very demanding, capital intensive and cutting edge nature of offshore petroleum activity provides opportunities to develop such capabilities. Norway, Denmark and the Netherlands provide European examples, while, in Canada, both Newfoundland and Labrador and Nova Scotia have had notable successes.

In Newfoundland and Labrador, Stratos Global, NEWDOCK, Shearwater Geophysical and Oceanic provide examples of local companies that have been able to capture offshore petroleum contracts,

leading to their developing new technologies and expertise that have, in turn, opened up new sectors and markets (Community Resource Services, 2003). Brooke Ocean Technology Limited, Survival Systems and Satlantic have been cited as similar success stories in Nova Scotia (Carey Ryan, pers. comm.).

When it comes to current BC technological strengths, 'An Integrated Strategy for British Columbia's Technology Clusters' (PricewaterhouseCoopers, n.d.) identifies five clusters:

- Information and Communications Technology;
- Wireless;
- New Media;
- Fuel Cells; and
- Biotechnology.

Most of these clusters have direct or indirect application to offshore petroleum industry, which has interests and requirements related to such issues as onshore/offshore communications, remote sensing, remote power sources, and the visual presentation of reservoir data. Furthermore, a number of BC companies with offshore petroleum industry interests and aspirations are working in these and related clusters. This includes firms engaged in the development of water detection and measuring equipment, solar-powered lights and seafloor mapping products and services. (British Columbia Offshore Oil and Gas Team, 2004) In addition, five BC companies have established Ocean Innovative Systems to provide the basis for developing markets for integrated ocean information systems, ocean and coastal management projects, and larger offshore petroleum projects (Innovation and Science Council of British Columbia, 2003).

It is important to incorporate these offshore petroleum related opportunities into the provincial strategy to further develop these technology clusters, and vice versa. Similarly, the development of BC offshore petroleum opportunities would be an important component of, and should be integrated with, any provincial strategy for developing the oceans sector.

### 4.2.2 Build on Local Challenges

The Atlantic Energy Roundtable is a federal/provincial initiative to identify challenges facing the offshore petroleum industry in Atlantic Canada and look for ways to improve regulatory efficiency and encourage increased investment and local involvement (Erlandson and PRAC, 2003, p.2). A report of its Regulatory Issues Steering Committee concluded that attempts to link R&D to the industry should focus on 'particular challenges presented by the operating environment', as well as 'improving understanding of the resource base and optimizing production' (p.73).

This follows on the experience to date in both Europe and North America, where a number of new capabilities (both in the areas of supplies and services and R&D) have developed in response to these 'particular challenges' and emerged as niche specialties. These have commonly been found to have application, and hence export potential, in other parts of the world and other industries. For example, as was noted above, Newfoundland and Labrador now has world-class capabilities in such areas as cold oceans engineering, distance technologies and marine science. Developed in large part in response to local offshore petroleum challenges, these capabilities are now being applied to that industry in such places as Greenland and Russia, and in such other industries as mining, shipping and aviation.

What are the 'particular challenges' presented by the offshore operating environment in BC? There are none that are as distinctive as the massive icebergs off Newfoundland and Labrador presented to the industry there. Some have suggested that BC weather and seismicity represent particular threats, although this is usually countered by reference to weather conditions in the Northern North Sea, Atlantic Canada, the Gulf of Mexico and the South China Sea, and to seismic activity in the Cook Inlet region of Alaska and to California. However, the combination of weather, seismicity and newer production systems may provide significant challenges and hence opportunities for R&D activity.

The biophysical and socio-economic environments are clearly also a challenge for the industry in BC. The latter might include the need to develop means by which some of the benefits from offshore petroleum activity accrue to smaller coastal communities. The presence of First Nations subsistence activities, as well as the importance of commercial fishing and tourism, allied to strong environmental sensibilities, will also require the use of 'world-class' and 'best practice' management techniques, which might be refined and further developed locally and then exported to other parts of the world and, perhaps, other industries.

### 4.2.3 Diversify the Economic Base

It is important that offshore petroleum activity be used to diversify the economy of BC, not solely by providing a new sector, but also by providing businesses and the economy as a whole access to new local, national and international markets.

This is partly because, for at least another decade, the presence and scale of offshore petroleum activity in BC are highly uncertain. Pre-exploration work may be halted at any stage given, for example, political change resulting in a renewed moratorium, or global and/or local factors causing the petroleum industry to lose interest. As has been discussed above, exploration work is similarly vulnerable; the seismic vessels, drilling rigs, support vessels and helicopters are all highly mobile and can move to another part of the world given a change in the political or economic circumstances, or disappointing local exploration results. Exploration is a highly 'footloose' industry, able to relocate from a region at short notice.

For this reason, it is important that any significant initiatives aimed at accessing offshore petroleum opportunities also have applicability to other industrial sectors and challenges, to onshore opportunities elsewhere in BC, or to other petroleum opportunities elsewhere within Canada and internationally. As has been seen in other jurisdictions, a premature focusing of effort, resources and investment on the offshore petroleum industry can lead to financial problems and even bankruptcies when there is a delay or cessation of activity.

Because of this, the safest opportunities for working in the industry are those that involve the traditional business of well-established local companies, thereby (as was discussed above) building on existing capabilities. This would include, for example, the provision of such services as longshore work, trucking and crane operations, ships' chandlering, marine transportation, marine repair, diving services, aviation support, customs brokerage, environmental permitting and monitoring, and the provision of accommodations and catering services. Any large investments directed at accessing offshore petroleum opportunities will be risky unless they also have current and/or potential in other industrial sectors or export markets.

More generally, the offshore petroleum industry is truly global. In Atlantic Canada, there has been a tendency to focus industrial development efforts on the opportunities presented by offshore activity in that region. This has commonly involved identifying how much work is occurring locally and what share is going to local companies or individuals, and then evaluating how any gaps can be filled. However, it is important to recognize the global nature of the petroleum industry and seek opportunities elsewhere. This helps insulate local companies from the cyclical patterns that afflict particular regions. It is also necessary to ensure industrial, and thereby socio-economic, sustainability.

### 4.2.4 Emphasize Health, Safety, Environment and Quality

The offshore petroleum industry is very rigorous when it comes to health, safety, environment and quality (HSEQ). It involves very large costs and revenues: drilling a single exploration well commonly costs $50 million or more, developing a large field can cost billions of dollars, and a such a field can produce oil or gas worth several million dollars a day. Any accident, failure of equipment, or delay in the delivering a key good or service, is very costly. Furthermore, the offshore environment is unforgiving, and accidents and equipment failures can easily be fatal or very damaging to the environment. Accordingly, the industry has very exacting and onerous requirements respecting HSEQ certification, management and monitoring.

This results in the industry requiring that its contractors and sub-contractors have very high quality expertise and equipment. This is a constraint and challenge to local companies wishing to secure petroleum industry contracts. However, companies that do develop the required capabilities, and

thus become locally competitive in this extremely demanding industry, are also competitive in the industry in other parts of the world, and in other industries. As such, the HSEQ challenges the offshore petroleum industry poses for local companies also represent, in the longer term, a significant opportunity. (There are also opportunities associated with the provision of HSEQ services to the industry.)

A recent study in Atlantic Canada (Community Resource Services, 2003) has shown that working for the offshore petroleum industry required and permitted 20 case study companies to acquire new premises, equipment, personnel and expertise. In particular:

- Premises and Equipment: Many firms found it necessary to move to new offices, warehouses and fabrication facilities, and to acquire top of the line equipment.

- Personnel and Expertise: All the companies had hired new people and provided existing personnel with additional training, both 'in-house' and outside the organization. This included increasing both the technical and business expertise within the company.

- Business Capabilities and Expertise: Given the demanding nature of the industry, especially respecting HSEQ, the companies had developed new capabilities in such areas as bid preparation, quality assurance, quality control, document tracking, monitoring and accounting. In many cases, this has included ISO certification.

Meeting such requirements can be daunting and expensive. Individual companies, or the business community as a whole, may respond by using collective initiatives. In the latter case, industry associations, Chambers of Commerce and Boards of Trade, often with government support and working hand-in-hand with the petroleum industry, may provide collective information and training.

Some companies also establish alliances or joint ventures. These may only involve local companies that combine so as to facilitate training, marketing, HSEQ certification and the like and to deliver a package of goods and/or services. (It appears that Ocean Innovative Systems is a BC group that conforms to this model (Innovation and Science Council of British Columbia, 2003).) Other companies partner with non-local companies so as to acquire relevant technology and expertise, or to benefit from an existing relationship with oil companies and major contractors. This results in technology transfer and eases access to business opportunities. Atlantic Canadian companies have established such joint ventures with companies in such places as the UK, Norway and Alberta. (Community Resource Services, 2003)

The rewards from successfully meeting the rigorous requirements of the offshore petroleum industry can be considerable. This is commonly reflected in the growth and increased profitability. The experience in many parts of the world is that it also leads to such businesses having increased

confidence, self-belief and ambition. As a consequence, involvement in the offshore petroleum industry has transformed them, including their business cultures, and this has communicated itself to other companies and, it has been argued, the local business community as a whole. (Shrimpton, 2002)

### 4.2.5 Plan to Benefit from Activity

This report it is primarily concerned with industrial development strategy, rather than approaches to requiring and enforcing the provision of economic benefits related to the industries' activities. The latter is largely a matter of legislation and regulation, constrained by such factors as the competing interests of the federal and provincial governments and First Nations, and the constraints posed by such trade agreements as the North American Free Trade Agreement (Davis and Company, 2002). It is a topic that is the subject of the Atlantic Energy Roundtable process, which will be a valuable source of information in thinking about the regulation of industrial benefits.

However, it is worth noting that oil companies may choose, or be required, to use various tools in ensuring the local effects of programs and projects are optimised, and these provide opportunities to increase local industrial benefits. For example, most jurisdictions require a socio-economic impact assessment of programs of activity or specific projects, and these commonly address and seek to optimize the employment and business impacts. However, environmental assessment legislation, processes and methods, and the environmental industry in general, focus on the mitigation of negative effects, and are poor at dealing with positive ones. For example, assessments under the *Canadian Environmental Assessment Act* normally only consider socio-economic impacts that result from biophysical ones, which are necessarily negative. (Shrimpton, 2004)

One response to this is the increasing use of plans that deal simply and solely with the industrial benefits of proposed programs and projects. For example, benefit plans are comprehensive documents that focus solely on local industrial benefits. They are required with respect to offshore petroleum exploration programs and development projects in Atlantic Canada, and commonly describe how some or all of the following topics will be addressed:

- Supplier Development: This includes the processes to be used to identify potential suppliers, provide them with information about technical, commercial and other requirements, and debrief unsuccessful bidders. Supplier development often involves joint initiatives between the petroleum industry, government and industry associations.

- Procurement: This includes the contracting process that will be used, including approaches to bid packaging so as to facilitate the opportunities for local companies.

- Research and Development: Benefits plans commonly include provisions aimed at ensuring that local suppliers of goods and services, and their employees, develop new technologies and capabilities related to industry requirements.

In the last case, there may be specific R&D expenditure commitments. For example, the Canada Newfoundland Offshore Petroleum Board Development Application Guidelines (CNOPB, 1988) require that benefit plans describe proponents' plans concerning the 'utilization of Newfoundland and other Canadian firms and institutions to undertake offshore-related research and development, and proposed research and development projects, and associated expenditures' (p.24). The CNOPB has developed draft guidelines as to the expected levels of expenditures, which may also be adopted by the Canada Nova Scotia Offshore Petroleum Board (Regulatory Issues Steering Committee, Atlantic Energy Roundtable, 2003, p.73)

In some cases, for example in Atlantic Canada, benefits plans also are required for exploration programs. However, as has been noted above, the opportunities for local involvement in such programs are limited and relatively invariable. The rig and main drilling services costs account for about 60% of all expenditures, with the Canadian content largely limited to air support, marine base and catering services, which typically account for about 20% of costs. Given this, exploration benefits plans have been described as fairly routine, but they involve a significant workload for petroleum companies in terms of preparing the plan and monitoring the actual benefits. It has been suggested that this requirement be waived, or reduced to a standard template that focuses on items where local content is reasonable, and a post-program audit of success (Erlandson and PRAC, p.70-71).

There may be a role for government in both regulating and funding offshore petroleum industrial benefits initiatives. Federal and provincial governments have been major contributors to such initiatives in Atlantic Canada, through departments and agencies with industrial and economic development responsibilities. This has included significant and ongoing support by the Atlantic Canada Opportunity Agency (the East Coast equivalent of Western Economic Diversification) and through the Atlantic Innovation Fund and Canada Research Chairs program.

In Newfoundland and Labrador, the federal and provincial governments also established, as part of the Atlantic Accord, a $300-million federal-provincial Offshore Development Fund to help prepare the province to take advantage of offshore petroleum development opportunities. A similar program was established in Nova Scotia. These programs funded the construction of a wide range of infrastructure, including some industrial infrastructure (for example, the Bull Arm platform construction site) and R&D facilities (for example, the Centre for Earth Sciences Research at Memorial University of Newfoundland).

The petroleum industry has also been a major financial contributor to the development of local supply, service and R&D capabilities in Atlantic Canada. This has included the involvements of individual oil companies in supplier development and R&D initiatives (the latter including contributions of equipment and software, the funding of research programs, and endowing research chairs), and joint contributions through CAPP, ESRF and PRAC. Some of these contributions are as part of the benefit plan commitments described above.

# 5.0 RECOMMENDATIONS

This section of the report outlines a recommended process for ensuring that BC makes the most of the industrial development opportunities associated with offshore petroleum activity. In line with the discussion above (Section 4.1), it addresses separately the required actions related to (i) the provision of supplies and services, and (ii) research and development activity. It describes a series of proposed initiatives for each of these, taking into account the considerations described in Section 4.2. This description of proposed initiatives is followed by a discussion of implementation considerations, including with respect to the management, timing and monitoring of the process.

## 5.1 Supplies and Services

As was discussed above (Section 3.0), there is a range of pre-exploration and exploration supply and service requirements that involve the use of existing local capabilities While the plan should focus on pre-exploration and exploration activity, it should also take into account the potential application of these supplies and services to later phases of offshore petroleum activity, as well as to onshore petroleum activity and other industries. This is seen as important given the need to focus industrial development efforts on those opportunities that are likely to provide the greatest returns with the least risk. This approach is in line with recent developments in Atlantic Canada, where the need to establish 'strategic priorities' has been noted in Atlantic Energy Roundtable deliberations (Erlandson and PRAC 2003, p.71).

These supplies and services opportunities should be explored through four staged initiatives:

- Review of Petroleum Industry Supplies and Services Requirements;
- Review of BC Supplies and Services Capabilities;
- Supply and Services Gap Analysis; and
- Supply and Services Plan Development.

The rest of this section describes the objective and the proposed methodology (including the role of different agencies and groups), duration and timing of each of these initiatives.

### 5.1.1 Review of Supplies and Services Requirements

Objective:

- To provide a detailed review of the nature and scale of offshore petroleum industry's likely supplies and services requirements in BC.

Methodology:

The identification of the industry's requirements should be based on the generic lists and inventories that are available, including those that contributed to the summary description provided in Section 3. A use of these sources should be supplemented by key informant interviews, not least to ensure that the review takes into account recent and likely future changes in technologies and practices.

The scale of activity, and hence likely demand for goods and services, should be estimated based on a review of the literature and key informant interviews. Estimates should be developed for minimum, median and maximum exploration activity scenarios, measured in terms of the number of drilling rigs and exploration wells per year. (The requirements associated with seismic testing are not such that there is value in estimating the scale of activity.) The scenarios, which should be developed in consultation with the petroleum industry and government, need not be very detailed or refined. They should take into account the effects of mobilization costs and asset sharing, given that they will likely result in a decreased scale, but increased duration, of exploration and related requirements.

Duration and Timing:

Work on this review, the first stage in developing a supply and service plan, should take about 10 weeks to complete. It should commence as soon as possible after a decision is made to raise the moratorium, so as to ensure an early completion and implementation of the plan.

### 5.1.2 Review of BC Supplies and Services Capabilities

Objective:

To document current BC capabilities relative to the supply and service requirements identified above.

Methodology:

The local capabilities report should be based on a review of business directories and other published materials, supplemented by key informant interviews with representatives of government departments and agencies and industry associations. The review should focus on the technical capability of companies to meet the requirements. However, as has been discussed above (Section 4.2.4), the offshore petroleum industry is very demanding when it comes to HSEQ, and any deficiencies in these areas should be noted.

Duration and Timing:

The capabilities study would take about 12 weeks to complete. While the Review of Supplies and Services Requirements will be important input to it, the collection and compilation of the required information on local capabilities could start before it is finished.

### 5.1.3 Supplies and Services Gap Analysis

Objective:

To identify BC opportunities to meet offshore petroleum goods and services requirements, based on the above assessments of industry requirements and local capabilities.

The gap analysis should aim to establish the supplies and services requirements for which:

- there is already adequate BC capability and capacity; and
- there would be a need to create or expand local capabilities and/or capacity.

In the latter case, the analysis should establish those additional supplies and services for which BC involvement is:

- not feasible, for example because there is well-established competition from low cost jurisdictions;
- feasible but not desirable, for example because the short-term or highly variable nature of the activity does not warrant the required investment; and
- both feasible and desirable.

This analysis should take into account the applicability of any new capabilities and capacity to development and production activity, to onshore activity, and to other industrial sectors. This is critical given the high degree of uncertainty and variability in the scale of offshore exploration activity. Furthermore, while the assessment should focus on the technical capabilities, it should also note and comment on deficiencies in HSEQ and other business capabilities.

Methodology:

The supplies and services gap analysis should review the ability of BC firms to meet the requirements associated with the three probable activity levels, but focus on the median scenario and emphasize the challenges posed by uncertainty. There would be three main stages to the work:

- a desk-top analysis of the reviews of requirements and capabilities, supplemented as necessary by key informant interviews, leading to the preparation of a draft gap analysis report;
- review and discussion of this draft report at one or more half-day workshops, attended by representatives of government departments and agencies, industry associations and the petroleum industry; and
- revision and finalization of the report on the basis of workshop input.

Duration and Timing:

The completion of the gap analysis would take about 16 weeks. Work on it should commence when draft copies of the requirements and capabilities reviews become available.

### 5.1.4 Supplies and Services Plan Development

Objective:

To develop a plan to appropriately foster BC's offshore petroleum industry supplies and services sector.

The Supplies and Services Plan should spell out:

- The plan process and mechanisms (e.g. the provision of education to the business community);
- Key decision points, such that actions are timely relative to the development of BC offshore activity;
- How the implementation and effects of the plan will be monitored, with the results fed back into the planning process;
- Organizational arrangements, including the roles of government, industry associations, companies and others;
- How the plan activities will be funded; and
- How the plan will provide input to, or otherwise be linked with, any regulated requirements respecting the offshore petroleum industry's use of BC supplies and services.

Methodology:

The Supplies and Services Plan should be developed through a consultation process involving representatives of the key stakeholders, including government departments and agencies, industry associations, members of the BC business community, and the petroleum industry. They might consist of all or some of those consulted for the gap analysis.

The consultation process would see:

- An initial series of workshops to review the gap analysis report (which would be distributed in advance, together with copies of key background materials) and receive input as to what the main elements of the plan should be;
- Preparation of a draft plan, based on discussions at the workshops;
- A second series of workshops to review and provide input to the draft plan; and
- Revisions to, and finalization of, the plan.

Duration and Timing:

The preparation of the Supplies and Services Plan would take approximately 20 weeks. While the plan development should build on the earlier steps, the initial work could be undertaken in parallel with them.

## 5.2 Research and Development

If BC is to make the most of the opportunities associated with offshore petroleum activity, it must have a strategic, petroleum-related, R&D plan. The need for such a plan for Atlantic Canada has recently been identified by a sub-committee of the Atlantic Energy Roundtable Regulatory Issues Steering Committee and Industrial Opportunities Task Force, which recommended that a 'strategic, petroleum-related, research and development plan' be prepared for the region. 'This plan should identify needs, match them with capabilities and set priorities that will add the greatest value to the region in the short, medium and long terms'. (Regulatory Issues Steering Committee and Industrial Opportunities Task Force, 2003, p.18)

The following initiatives are recommended in the development and implementation of such an R&D plan for BC:

- Review of R&D Requirements;
- Review of BC R&D Capabilities, Aspirations and Plans;
- Establish R&D Opportunities, Priorities and Related Requirements; and
- R&D Plan Development.

The rest of this section describes, for each of these initiatives, its objective and the proposed methodology (including the roles of different groups), scale, duration and timing.

### 5.2.1 Review of R&D Requirements

Objective:

To identify R&D requirements by assessing the challenges facing the offshore petroleum industry, generally and in BC in particular.

Methodology:

As was discussed above (Section 4.2.2), the development of R&D in BC should take into account the 'particular challenges' presented by the local offshore operating environment. The identification of the challenges facing the industry, generally and in BC, should start with a review of the literature. This should include recent reports on prospective offshore petroleum activity in BC (e.g., Jacques Whitford Environment Limited (2001), Strong et al (2002) and Royal Society of Canada (2004)), which identified various 'knowledge gaps'. It should also include reports on and about the main Atlantic Canadian, European and other offshore petroleum R&D initiatives (see Section 4.1).

The literature review should be supplemented by consultation with the petroleum industry, relevant government agencies and the local business community, possibly in the form of one or more small workshops. The research would also benefit from the involvement with groups dealing with the issue of offshore petroleum R&D requirements in other parts of the world. This might include such groups as PRAC, the Research Council of Norway, and the UK Industry Technology Facilitator (see Section 4.1) and the European Oil and Gas Innovation Forum (2004).

Duration and Timing:

Work on the review of R&D requirements would take about 14 weeks to complete, and should commence as soon as possible after a decision is made to raise the moratorium.

### 5.2.2 Review of BC R&D Capabilities, Aspirations and Plans

Objective:

To review BC R&D capabilities, aspirations and plans both generally and as they relate to the challenges identified by the review of R&D requirements, and to identify existing areas of local expertise that could benefit from there being offshore petroleum activity in BC.

Methodology:

This initiative would be based on a review of the literature, and consultation with government departments and agencies, universities, and others involved in R&D and its planning and support. The consultation could again involve one or more small workshops with key representatives of the above groups.

Duration and Timing:

It would take about 14 weeks to complete the review of R&D capabilities, aspirations and plans. Work on it should commence upon completion of the R&D requirements study.

### 5.2.3 Establish R&D Opportunities, Priorities and Related Requirements

Objective:

To identify BC R&D opportunities, priorities and related requirements, with the last including infrastructure needs. This should again take into account the feasibility and desirability of undertaking R&D related to different issues.

Methodology:

The analysis should be in three stages:

- a desk-top exercise, comparing the R&D requirements and capabilities established above, supplemented as necessary by key informant interviews, leading to the preparation of a draft report on opportunities, priorities and related requirements;
- a workshop, involving representatives of government departments and agencies, universities, the petroleum industry, and agencies involved in petroleum related R&D initiatives in other jurisdictions (such as those listed in Section 5.2.1) to review, and provide input to, the draft findings (which would have been circulated in advance); and
- the preparation of the final report on R&D opportunities, priorities and related requirements.

Duration and Timing:

The review of R&D capabilities, aspirations and plans would take about 18 weeks to complete. It should commence when the draft R&D requirements and capabilities studies become available.

### 5.2.4 R&D Plan Development

Objective:

To develop a plan to build offshore petroleum industry R&D capabilities and activity in BC.

The R&D Plan should describe:

- The plan process and mechanisms;
- Organizational arrangements (e.g. the roles of governments, universities, industry associations, funding agencies, the petroleum industry and others);
- How the implementation and effects of the plan will be monitored, with the results fed back into the planning process;
- How the plan activities will be funded; and
- How the plan will provide input to, or otherwise be linked with, any regulated offshore petroleum industrial benefits R&D requirements.

Methodology:

The development of the R&D Plan is best done through a consultation process involving representatives of the key stakeholders, including government departments and agencies, the BC business community, funding agencies, universities and the petroleum industry. It might also benefit from the involvement of agencies and groups involved in petroleum related R&D initiatives in other jurisdictions. Those consulted might consist of all or some of those involved in the establishment of opportunities, priorities and related requirements.

The R&D Plan development process would see:

- An initial series of workshops to review the R&D opportunities, priorities and related requirements report (distributed in advance, with copies of key background materials) and solicit input as to the main elements of the R&D plan;
- Preparation, on the basis of these workshops, of a draft R&D plan;
- A second series of workshops to review, and provide input in response to, the draft plan; and
- Revisions to, and finalization of, the R&D plan.

Duration and Timing:

The process of developing an R&D Plan for BC, based on the earlier initiatives described above, would take about 16 weeks. It should commence shortly before the completion of the report on R&D opportunities, priorities and related requirements.

## 5.3 Implementation

### 5.3.1 Management

The overall process of undertaking the above-noted initiatives should be managed by a government agency or industry association, working with a multi-stakeholder Management Committee that would ensure that the work is completed on time and within budget. Given that there will be a long-term requirement to oversee the implementation of the supply and service and R&D plans, and monitor their effectiveness, there could be merit in its taking the form of an overall BC offshore petroleum committee or council. It would oversee the above process and the implementation and monitoring of the plans in the broader context of BC's industrial benefits and economic development goals. Its membership would be drawn from many of the stakeholder groups noted above.

Separate Steering Committees should be responsible for directing the supply and service and R&D work. The members of these committees, some of whom would be drawn from the Management Committee, should have specific expertise and experience related to the topics under review.

The proposed process involves a mix of research, consultation and planning. The agency or industry association responsible for the process might undertake some of this work, but it will likely be both necessary and desirable to contract much of the work to consultants or others familiar with the workings of the offshore petroleum industry. In the case of the R&D initiatives, they should also be familiar with that topic and the BC R&D community. While the different supply and service and R&D research and plan development processes and initiatives might be contracted separately, there would be advantage to having a single group or company taking responsibility for several or all of them.

One of the goals of the research and plan development process should be to educate all of those involved to the workings of the offshore petroleum industry, its requirements, and the associated challenges and opportunities. In this connection, it would be advantageous to have the work undertaken by a BC team or a team with BC participation, and this should be encouraged through the bidding process.

### 5.3.2 Timing

The full research and plan development process will take about 14 months, and should be initiated as soon as possible. While the above analysis (Section 2.0) indicates that there will be long timelines for the development of BC offshore petroleum industry, there will be some pre-exploration opportunities soon after the moratoria are lifted, and plans should be in place to benefit from these and all subsequent opportunities. However, it should also be recognized that the types and scale of

petroleum industry requirements will change over time, and that there must therefore be an ongoing process to monitor developments and review and revise plans.

### 5.3.3 Monitoring

As was noted above, the offshore petroleum industry is subject to rapid change in terms of the nature and scale of activity, technologies used, and associated requirements. Accordingly, it is going to be necessary to regularly revisit and revise the supply and services and R&D plans. Changes, and the implications for local requirements will have to be monitored, leading to revisions in the plans for optimizing the benefits to BC.

# APPENDIX 1

# REFERENCES

## References


British Columbia Offshore Oil and Gas Team, 2004. British Columbia Offshore Oil and Gas: Serving the Offshore Industry. Ministry of Mines and Energy.

British Columbia Speech from the Throne. February 11, 2003. Delivered at the Opening of the Fourth Session, Thirty-Seventh Parliament of the Province of British Columbia.

Campbell, C.M., and Community Resources Services Ltd., 2002a. Analysis of Potential Services to the BC Offshore Oil and Gas Industry. Report prepared for The Pacific Offshore Energy Group.

Campbell, Chris M., and Community Resources Services Ltd., 2002b. Inventory of Potential Supply and Service Providers to the Offshore Oil and Gas Industry. Report prepared for The Pacific Offshore Energy Group.

CNOPB, 1988. Development Application Guidelines: Newfoundland Offshore Area. Canada-Newfoundland Offshore Petroleum Board.

Collyer, D., 2003. An Exploration & Production Perspective on the West Coast Offshore. Presentation prepared for the BC Natural Gas Symposium – May 7, 2003.

Community Resource Services, 2003. Socio-economic Benefits from Petroleum Industry Activity in Newfoundland and Labrador. Report prepared for Petroleum Research Atlantic Canada.

Davis and Company, 2002. Developing BC's Offshore Oil and Gas Resources: Executive Briefing.

Erlandson & Associates and Petroleum Research Atlantic Canada, 2003. Challenges and Opportunities for Regulatory Effectiveness in the Offshore Accord Areas of Nova Scotia and Newfoundland and Labrador. Report to the Regulatory Issues Steering Committee, Atlantic Energy Round Table.

European Oil and Gas Innovation Forum, 2004. http://www.oil-itf.com/about/introduction.htm

Gardner Pinfold Consulting Economists, 2002. Economic Impact of Offshore Oil and Gas Development on Nova Scotia, 1990-2000. Report prepared for the Nova Scotia Department of Energy.

Industry Technology Facilitator, 2004. http://www.oil-itf.com/about/introduction.htm

Innovation and Science Council of British Columbia, 2003. Development of British Columbia's Ocean Technology Sector: July 2003 Update.

Jacques Whitford Environment Limited, 2001. British Columbia Offshore Oil and Gas Technology Update. Report prepared for the BC Ministry of Energy and Mines.

Mikkelsen, A., K. Josendal, J.M. Steineke and A. Rapmund, n.d.. TIP Focus Group on Energy Innovation System Country Report: Upstream Oil and Gas in Norway.

Ministry of Petroleum and Energy, 2004. Facts 2004: Norwegian Petroleum Activity. Report by the Norwegian Ministry of Petroleum and Energy.

Ministry of Petroleum and Industry, 2002. Major Values in Future Oil and Gas Production. Press release for the Norwegian Ministry of Energy and Mines, 28th June 2002.

Pacific Offshore Energy Association. POEA Perspective: What needs to be done for the BC Offshore to become an opportunity?

PriceWaterhouseCoopers, n.d.. An Integrated Strategy for British Columbia's Technology Clusters: A White Paper. Prepared for the British Columbia Technology Industries Association and others.

PricewaterhouseCoopers, 2001. Final Report: A Study into Optimizing Technology Transfer for Atlantic Canada's Oil and Gas Industry. Report prepared for the Newfoundland Oceans Industries Association, Offshore/Onshore Technologies Association of Nova Scotia, Atlantic Resources Industries Association of New Brunswick, and Canadian Manufacturers and Exporters – Prince Edward Island.

Province of British Columbia, 2002. The BC Heartlands Economic Strategy.

Province of British Columbia, 2004. The Province of British Columbia's Perspective on the Federal Moratorium on Oil and Gas Activities, Offshore British Columbia.

Shrimpton, M., and K. Storey, 2000. Managing the Relationship Between the Offshore Oil Industry and Frontier Regions. Paper presented at the SPE International Conference on Health, Safety and the Environment in Exploration and Production, Stavanger, Norway.

Shrimpton, M., 2002. Benefiting Communities: Lessons from the Atlantic. Paper presented at the Developing BC Offshore Oil & Gas conference, Victoria, BC.

Strategic Concepts, Inc., Dr. W. Locke and Community Resources Services, 1999. Harnessing the Potential – Atlantic Canada's Oil and Gas Industry. Report prepared for the Newfoundland Oceans Industries Association, Offshore/Onshore Technologies Association of Nova Scotia, and Canadian Manufacturers and Exporters – New Brunswick.

Strong, D., P. Gallagher and D. Muggeridge, 2002. British Columbia Offshore Hydrocarbon Development: Report of the Scientific Review Panel. Prepared for the BC Ministry of Mines and Energy.

The Royal Society of Canada, 2004. Report of the Expert Panel on Science Issues Related to Oil and Gas Activities, Offshore British Columbia. Report prepared for Natural Resources Canada.