

Module 6: Non-Renewable Resource Economies of the North: Petroleum Extraction

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Overview

Northern economies are largely natural resource based with significant dependence on *renewable* and *non-renewable resources*. Industrial development in the North is characterized by large-scale natural resource extraction often serving distant markets. Oil and gas (e.g. non-renewable petroleum resources) are among the most valuable and leading non-renewable resources in several regions of the North with reserves located on land, the coastal shelf and under the Arctic Ocean. Since the 20th century, commercial exploitation has increased significantly and oil and gas exploitation is expected to remain a key economic force in the North.

On- and off-shore oil and gas activities are substantial in the Arctic and have a key role in industrial and economic development. The Arctic has several unique physical, biological and societal characteristics that set it apart from other regions. This means the region faces a number of distinct challenges related to resource extraction, including permafrost and sea ice, disruption to biological species, remoteness and lack of accessibility, limited human resources for large-scale industrial projects, and potential impacts on Indigenous communities, cultures and traditions. With rising global demand and an increased desire for stable and secure supply, it is expected that oil and gas and other non-renewable resource activities will continue to expand despite observed and projected physical, environmental and human costs.

Learning Objectives

Upon completion of this module, you should be able to:

1. Explain the economic role the primary resource sector plays in the circumpolar North.
2. Distinguish elements of the structure of the oil and gas industry across the Northern region.
3. Outline phases in the development of an oil economy, including transportation for oil and gas resources.
4. Identify socio-economic factors required to facilitate development of oil and gas resources in the North.
5. Analyze financial considerations of developing oil and gas resources in the North.

Required Readings (including web sites)

Glomsrød S., Mäenpää I., Lindholt L., McDonald H. and S. Goldsmith. (2008). Arctic economy within the Arctic nations. In Solveig Glomsrød and Iulie Aslaksen (Eds.), *The Economy of the North*. Statistics Norway. http://www.ssb.no/a/english/publikasjoner/pdf/sa112_en/kap4.pdf Arctic Monitoring and

Assessment Programme (AMAP). (2007). *Report on Arctic Oil and Gas*. Accessed via <http://www.amap.no/oga> pages v-xii, and pages 31-37.

Key Terms and Concepts

- Alaska Oil Funds
- Capital Intensive Production
- Dutch Disease Phenomenon
- Economic Diversification
- Economic Rent
- Environmental Impacts
- Economic Linkages (Backward, Forward, And Final Demand Linkage)
- Factor
- Gross Domestic Product (Gdp)
- Industrial Development
- Oligopoly
- Petroleum Extraction
- Primary Exports
- Resource Flows
- Royalties
- Sustainable Development

Learning Material

Introduction

This module examines the role played by the primary resource sector in the non-renewable resource based economy of the circumpolar North, particularly the oil and gas industry. The evolution of the petroleum sector will be highlighted, followed by an overview of some socio-economic factors required for large-scale resource development.

Key to the Arctic market-based economy is its role as a large reservoir of natural resources, often extracted by multinational corporations and used primarily in distant markets. Large-scale resource extraction and associated industrial development affect all aspects of economic life in the North. While resource development can be an important growth and development engine in the North, creating forward and backward economic linkages and opportunities for employment and income creation in local communities, recurring challenges cannot be overlooked. Exploitation may give rise to economic instability frequently associated with a narrowly based economy, outflows of profits and resource rents, lack of economic benefits remaining locally, the boom and bust nature of the industry, and pollution such as oil spills.

6.1 Role of the Primary Resource Sector in the Circumpolar North

The Arctic economy can be divided into three main parts: a formal and market based economy, an informal or non-market economy (subsistence) and a transfer sector. The relative size of each of these parts varies throughout the circumpolar North. The formal, market based economy is characterized by extensive natural resource exploitation, including renewable and non-renewable resources, such as metallic minerals, precious metals, hydrocarbons, precious and semi precious stones, and fish. The primary resource sector and its contribution to exports and earnings is a major driver of the formal economy.

Primary resource exports produce trickle-down effects that are a contributing factor to economic growth and development in many northern regions. Theories have been developed to analyze the development of primary exporting countries. Among these is the staple theory, which examines the development of primary exporting countries in terms of various characteristics of a country's staples. A staple is defined as a primary product that faces a large and growing demand in world markets, does not require elaborate processing and has a high enough value-weight ratio to bear transportation costs. Central features of the staple theory are spread effects, the process of diversification around the export base, and the economic development that follows. Oil and gas resources exported to world markets can be viewed in similar ways. Significant shares of extracted northern resources are exported. While resources may leave the region, this may lead to positive spin-off effects related to extraction and indirect effects related to secondary activities that support the industry. Benefits to primary export-led growth may include improved utilization of existing factors (e.g. land, capital, labour, minerals), expanded factor endowments and economic linkage effects where the resulting linkage effects are referred to as backward, forward and final demand linkages. Research suggests primary exports may not be as effective for growth as other economic activities because primary exports may not lead to economic development partly because markets for primary products often grow too slowly to fuel growth and earnings may be unstable due to frequent price fluctuations. Also, expected diversification around the export industry and creation of economic linkages tends to be weak or non-existent.

Aside from leakage of economic profits and resource rents from northern regions, thereby limiting the economic benefits to the North, economic instability caused by dependence on a narrow range of natural resources and the associated high concentration in export commodities is a significant challenge facing resource dependent economies. The *Dutch-disease* phenomenon is a concept that tries to explain the adverse effects on a country's other industries that may occur when one industry substantially expands its exports resulting in appreciation of the currency and a resulting decline in manufacturing.

While the petroleum industry creates significant wealth, income and jobs, it does not always benefit northern residents. A significant share of the wealth created through large-scale resource extraction may not remain in the Arctic or benefit residents of the region. Large-scale exploitation activities frequently use labor and capital inputs from outside the region. A sizable share of Gross Domestic Product (GDP) is generated in the form of resource rents and return to capital. These profits and rents may leave the area when capital ownership and control is located outside the region. While GDP is high

throughout much of the North, it may not accurately reflect what is actually available for consumption and investment in the region. Consequently, these resource flows in and out of the region tend to limit GDP's value as a reliable and non-biased measure of the region's level of material well-being.

Learning Activity 1

Describe the primary resource sector in your region.

Petroleum is a fossil fuel and a key non-renewable resource in the circumpolar North. When first extracted petroleum is known as crude oil and may be mixed with various gases, solids and trace minerals. A variety of fuel products are produced through refinement processes such as gasoline, jet and diesel fuel. Crude oil is also a raw material for synthetic chemicals and used for making asphalt. Petroleum products are used for making a broad range of products such as plastics, paints, cleaning fluids, among other things.

As much as ninety-seven percent of total Arctic oil and gas production takes place in Alaska (in particular, Prudhoe Bay on the North Slope) and Northern Russia (i.e., West Siberia and Timan Petchora located in the Republic of Komi and the Nenets region). Explorations in the Norwegian sector of the Barents Sea have also yielded several discoveries, including the Snøhvit gas field. The Arctic share amounts to 20.5 per cent and 27.6 per cent of undiscovered oil and gas, respectively. The large volumes of discovered and undiscovered reserves have fuelled expectations of continued wealth, extensive future oil discoveries and future declines in dependence on imports from politically unstable areas. The Persian Gulf region, where about sixty-five percent of the world's known petroleum deposits are located, accounts for the greatest production of crude oil in the world. Events in this often volatile region have a huge impact on oil prices worldwide. Changes in oil and gas prices can lead to significant shifts in Arctic economies because of the crucial role oil plays in the region. This helps explain why relying on a few resources with significant exposure to the effect of changing external markets and boom and bust periods associated with business cycles can leave Arctic economies volatile.

While financial returns from petroleum activities are significant so are environmental and human costs. Continued large-scale exploitation activities are often met with strong opposition from environmental groups concerned about environmental damage caused by the industry and argue petroleum production might damage the vulnerable Arctic ecosystem.

6.2 Oil and Gas Industry Structure in the North

In most parts of the North, oil and gas reserves in the ground are owned by the state in which they are found or, in the case of undersea reserves, by the state adjacent to the reserves. This is usually referred to as state ownership. There are two basic models of governance: American and the European (e.g. North Sea). The distinction between these models rests on differing rights of private enterprises to underground hydrocarbon resources and the roles of the state in the oil and gas sector. In the American model (e.g.

in the United States and, to a lesser degree, Canada), the state primarily plays a regulatory role. Private companies exercise considerable control over the development and production of oil and gas resources. Resource concessions are usually granted through an auction system involving domestic and international resource companies.

By comparison the European or North Sea model (e.g. in Norway and Russia) can be described as an interventionist or state-capitalist system. Although private companies participate directly in the development and production of resources, the state, in the form of a national oil company, plays an important role in resource management. The state controls the administrative allocation of production licenses and usually imposes stiff requirements on private companies.

6.2.1 The Soviet and Russian Experience

The characteristic difference between oil and gas operations in Russia and those in other northern areas is that until the early 1990s a major part of the industrial infrastructure was controlled by a centrally planned Soviet economy. The Soviet Union was the world's largest producer of oil and gas, and the petroleum industry was an integral part of the state structure. The state was the sole owner and developer of natural resources and excluded market forces from influencing resource management.

Oil was first discovered and produced in Baku and throughout the Caucasus region in the late nineteenth and early twentieth centuries. Like the Soviet Union, oil production and the oil industry really only reached high power status after the Second World War with the discovery of significant oil fields in the Volga region in the 1950s and in Western Siberia in the 1960s. The Western Siberian oil fields, located mostly in the province of Tyumen, provided the bulk of the Soviet oil production in the 1970s and 1980s.

After the dissolution of the Soviet Union in 1991, Russia underwent a period of socio-economic reform resulting in the introduction of market forces. In February 1992, the highest governing bodies of the newly independent Russian Federation passed the Law on Underground Resources. This legislation laid the foundation for the use of underground resources including the interests of the "centre" and the regions (e.g. the constituent units of the Russian Federation).

After 1991, the Russian oil industry was reorganized into separate companies and then privatized on a large scale. The gas industry was not broken up but became one company, Gazprom, with prominent state ownership and a near-monopoly.

In Russia today, the reorganization of oil and gas projects means state and state-owned petroleum companies have been placed in leading roles. It also means the positions of foreign and non-state-owned endeavors in the oil and gas sector have been minimized.

The Russian model of developing oil and gas resources conforms to the "principles of two keys", whereby authority in deciding questions of rights over the use of underground resources is constitutionally shared by the federation and the regions. Given the transitional nature and political instability of the Russian Federation, the two keys approach caused a number of conflicts between federal and regional governments over issues such as ownership and control of natural resources.

In Northern Russia, the Khanty-Mansiisky Autonomous Okrug (district) is the uncontested leader in the establishment of legislation on natural resources. In recent

years, based on its constitutional rights and authority, the Okrug began establishing a clear and well-developed legislative framework to serve as the basis for oil and gas development. A specialized academic research centre was founded to study problems of exploitation of underground resources and find solutions to questions of how to make more effective economic use of oil and gas resources.

Paralleling the formation of new systems of resource legislation in Russia was the restructuring of the oil and gas sector. The establishment of private and quasi-private vertically integrated companies engaging in all production activities, ranging from exploration to refining and sales, was a major departure from the Soviet system. The state still plays a key role as a regulator and producer of oil and gas, but the emergence of private companies in the 1990s brought Russia closer to the American model.

About four million square km of the Russia's continental shelf are of potential interest for oil and gas production. The petroleum industry (i.e., Gazprom and Rosneft) have expressed interest in off-shore petroleum development. Rosneft is the country's largest oil company. Gazprom accounts for approximately eighty-seven percent of Russian gas production. It is the world's second-largest energy company and holds a monopoly on gas exports. Today, oil and gas export revenues account for about sixty percent of the Russian federal budget.

Large-scale and fast paced changes in oil and gas development come at a cost. In the Russian North it has contributed to significant social problems including increased migration, changing population and settlement structures, increased ecological risks and catastrophes. It has also led to increased access to remote regions and local Indigenous communities, which has impacted the social and cultural fabric of the region.

6.2.2 The Norwegian Experience

Arctic Norway has primarily pursued petroleum exploration, while petroleum production is carried out further south in the North Sea. As fields in the North Sea are emptied, the focus is turning towards the North for further production. The development of Norwegian petroleum resources and competitive production has been linked to close collaboration between authorities, oil companies, research institutions and universities.

Since the early 1970s, Norway's key oil and gas industry goals have been national management and control, building a Norwegian oil community and state participation. The Storting, the government, and the Norwegian Petroleum Directorate, a state agency, administer petroleum operations. Decisions regarding the opening of new fields rest with the Storting, while the government awards licenses for petroleum operations. Since Norway is a unitary state, authority over matters of resource exploitation and development rests with the central government.

In the initial phase of oil and gas development, foreign companies dominated exploration off the coast of Norway and were responsible for developing the country's first oil and gas fields. While these multinational firms were supposed to play an important long-term role, the goal of building up a Norwegian oil community was defined at an early stage. Statoil was created as a state-owned oil company and the principle of fifty percent state participation in each production license was established. The Storting later decided that

the level of state participation could be higher or lower than fifty percent depending on the circumstances. In 1980, the first production licenses North of the 62nd parallel were awarded.

6.2.3 The Canadian Experience

The petroleum industry is a major player in the Canadian economy. Canada is the seventh largest [oil producing country](#) in the world. The production of crude oil, crude bitumen and natural gas concentrate amounted to an average of 438,000 cubic meters per day in 2008, of which just less than fifty percent was conventional crude oil and about fifty percent was bitumen from the oil sands. The United States accounts for the vast majority of Canadian exports of petroleum production and the largest share of its oil imports originate from Canada. Statistics show that in Alberta alone more than 100 new oil wells are drilled each day, and in 2005 more than 25,000 new wells were drilled in Canada as a whole. Oil and gas extraction has declined in Canada. During the period 2001 to 2008, the volume of oil extraction declined by almost forty percent, while gas extraction declined by almost eighty percent between 2000 and 2008.

In Canada resource politics is influenced by two important variables: regional concentration of natural resources and the constitutional division of powers between the federal and provincial governments. Canada's oil and gas deposits are concentrated in the western provinces of Alberta and Saskatchewan and off-shore deposits off the coast of Newfoundland and Nova Scotia in eastern Canada. Historically, the resource provinces have occupied a peripheral position in relation to the more politically and economically powerful provinces of central Canada. The federal government decided to create Petro-Canada, a state-owned resource company during the energy crisis, which was part of a shift in Canada's resource management orientation from an American model to the European model. The situation now has elements of both models. According to the Canadian constitution, jurisdiction over land-based natural resources, such as oil, rests exclusively with the provinces. This means that provincial governments, like some of the regional governments in post-Soviet Russia, played key roles in the development of legislation and policies for managing natural resources. Nonetheless, the federal government has control over off-shore resources and resources located on or below federal lands, and responsibility to oversee development of the Canadian economy as a whole. The federal government's use of interprovincial trade, and trade and commerce power has enabled it to legislate in areas of provincial jurisdiction (e.g. oil and gas sectors).

6.3 Developing an Oil Economy

The oil and gas industry has two key parts: upstream, which describes the exploration and production sector and downstream, which deals with refining and processing of crude oil and gas products, as well as their distribution and marketing. Companies operating in the industry may be fully integrated (e.g. have both upstream and downstream interests) or may concentrate on a particular sector, such as exploration and production. Many large companies operate globally and are known as multinationals. Usually only large (mostly

multinational) corporations have the capacity to finance, design, construct and operate large scale resource projects (e.g. petroleum extraction) because of the large size and immense costs of these projects. If the exploration stage is successful, more drilling is undertaken to determine the size and extent of a field. At the appraisal stage an evaluation is undertaken to evaluate the size and nature of the petroleum reservoir and determine whether further seismic work is necessary.

Much activity connected to oil and gas operations tends to occur in the early stages, particularly during construction. During construction the demand for labour is high, but jobs created tend to be of short duration and the majority disappear once in the less labour intensive operations phase. The construction phase is also characterized by influx of labour from outside the region to fill positions not easily filled by local labour. In the production phase, jobs are more stable but there are fewer of them. Social problems may be particularly frequent in early stages of oil and gas activities partly because of the unstable nature of employment created and the influx of workers from outside. Labour influx can lead to community disruption, pressure on local infrastructure and community services, and changed demographics.

Large oil fields can require a hundred or more wells, whereas smaller fields may require only ten or so. Drilling involves similar techniques to those used for exploration. However, well sites are occupied longer and support services (e.g. workforce accommodation, water supply, waste management and other services) correspondingly increase. Since the production operation is a long-term development, temporary facilities used in exploration are replaced by permanent facilities. The temporary workforce associated with exploration activity is replaced by a permanent workforce, usually accommodated in the local area and sometimes fully integrated with the local community. The proportion of the workforce recruited locally varies.

There are essentially four phases: *pre-discovery*, *pre-maturity*, *maturity* and the *post-maturity* phase.

- **Pre-discovery:** The first phase, where information is scarce and geological risk is high, as are the potential rewards. The first phase occurs before commercial finds are made and usually lasts several years. Companies willing to take exploration risks are large multinational oil companies, independent companies, small newcomers and state-owned oil companies looking for secure supplies. This phase ends with the first commercial resource discovery.
- **Pre-maturity:** The second phase, where geological knowledge about resources in a particular area improves rapidly resulting in diminished risks. Companies make more and larger discoveries as their knowledge of the geology improves. Marginal unit costs fall and development of infrastructure to service the oil economy commences. Increasing economies of scale in infrastructure and field development tend to favour multinational and state-owned oil companies, both of which strengthen their positions during this phase. Economies of scale also favour coordination within and between large integrated companies. The outcome is usually a less than fully competitive environment with strong features of oligopoly and vertical control of subcontractors. Independent oil companies and small newcomers gradually lose out. In this phase, companies consider smaller

finds with less interest because they anticipate larger discoveries with lower unit costs. After an oil province has been put on the map, risk is reduced. This phase ends when the size of new finds peak.

- **Maturity:** The third phase is the maturation phase, when the discovery rate stabilizes, but finds gradually diminish in size. During this phase geological knowledge is high, risk is low and marginal unit costs stabilize. Infrastructure is practically complete contributing to cost stabilization because it is essentially financed by large fields. Strong economies of scale are clearly apparent in infrastructure and large field operations. Smaller fields may qualify for development, but only if they have a favourable location close to existing infrastructure. In an established, mature oil region with low risk, multinational oil companies are in a dominant position with state-owned companies, particularly the state oil company of the host country. The outcome is usually an industry dominated by few companies coordinating activities vertically within themselves and horizontally between each other. The result is that oligopolistic features of the industry become stronger and independent oil companies and small newcomers generally find themselves in a fairly weak position. This phase ends when oil production peaks for the first time. This usually indicates an advanced depletion of large fields with production moving to more marginal prospects.
- **Post-maturity:** The fourth phase is the post-maturity phase, where knowledge remains high, but risk rises again. Discoveries essentially consist of small fields or fields with adverse characteristics such as high water content. Smaller, unexploited finds remain from earlier phases. Infrastructure coupled with enhanced knowledge and technical and organizational innovation gained from earlier experience permits the economic exploitation of more marginal fields. The combination of infrastructure, knowledge and innovation usually makes marginal costs stabilize or increase slowly, permitting the prolongation of the post-maturity phase for decades. Economies of scale become gradually less important than low costs, flexibility and inventiveness.

6.4 Socio-Economic Factors Required for Oil and Gas Development

Oil and gas activities in the North are major drivers of social and economic change. Considerable reserves remain for future exploitation. The size and rate of change of economic activity of oil and gas exploration and production depend on a number of economic and societal considerations, including changes in regulations and technology, and processes of global change. The petroleum industry creates regional and local business and economic opportunities throughout the North. It helps generate public revenues through taxation and royalty payments, which are the basis for spending on public services, and social and economic programs. But the arrival of new workers can cause social and cultural disruptions in small and remote communities. A portion of economic benefits may leak out of the region and net benefits to the local area may be negative. Potential environmental impacts raise critical questions and point to the growing conflict of interest over land-use between Arctic stakeholders. Petroleum has a highly toxic composition and poses significant problems when used in huge volumes. An

essential part of reducing negative impacts and capturing potential benefits is effective governance entailing clear decision-making, public involvement and effective regulatory regimes.

Some socio-economic factors required to facilitate development of oil and gas resources include a trained workforce (and for permanent operations a local workforce), community support (including co-management agreements), availability of community services, an ability to meet growing demands for housing by temporary and long-term workers, changes in patterns of tourism and recreation, local infrastructure to accommodate pressures of growing local populations, and well-developed transportation systems.

The contribution to the regional economies of oil and gas activities is considerable, but socio-economic effects in the North can be positive and negative. The largest socio-economic effects tend to occur during development and construction phases. Some potential socio-economic costs may include:

- Profits and resource rents leaking out of the North.
- Equipment and facilities imported from the south where their manufacturing takes place.
- Exploration and production companies retaining managerial experience and technical knowledge gained resulting from resource development so it does not remain in the community.
- Sudden increases in the local labour force with the import of workers for the resource development project which may contribute to social problems and pressure on community infrastructure and housing.

While industrial development is extensive, large shares of profits and resource rents may disappear from the region to those who own and control capital thereby not benefiting local consumption and investment. GDP tends to be an incomplete indicator of material well-being in resource dependent regions because of resource outflows and the use of imported labour and foreign capital.

Learning Highlight 2

The petroleum industry is characterized by several distinctive phases, each associated with a level of

Socio-economic agreements may help limit negative impacts of petroleum extraction. In Canada, until recently the Government of the Northwest Territories could not set terms for resource development on Federal Crown land. However, when an environmental assessment takes place for a major resource development, the NWT requests follow-up programs in the form of socio-economic agreements. The Department of Industry, Tourism and Investment is responsible for negotiating agreements on behalf of the NWT. The department also oversees implementation of agreements and coordinates government efforts under each agreement while monitoring how well each company carries out its respective responsibilities.

Socio-economic agreements may consider:

- Employment and business opportunities
- Cultural well-being and traditional economy
- Community, family and individual well-being
- Net effects on government
- Sustainable development.

Oil and gas are non-renewable resources and will be exhausted eventually because of their finite supply. Properly managed investment funds can help provide a longer term and sustainable flow of income just as land claims settlements can help provide more secure benefits to Indigenous communities.

Various different approaches are required to strengthen the influence and role of the oil and gas sector in solving social and economic problems. These include stipulating the terms of service and use of domestic manufacturers and transportation, hiring a local workforce, and developing local labour and transport infrastructure, among other things. These conditions can only be achieved in their entirety if there is a functioning economy, stable norms and laws, and a state that guarantees laws are respected. Therefore, residents of Alaska and its Indigenous populations are not entirely opposed to the planned development of new territories such as the North Slope since their past experiences have been relatively positive.

Alternatively, in Russia the ineffective system of controls and monitoring ecological and social impacts of the oil and gas industry in the 1970s and 1980s became a reason for the populations of the Northern territories to oppose new oil and gas exploration and development in the Yamal Peninsula. Past oil and gas development in Northwestern Siberia contributed to sharp increases in the population of the North. For example, the population of the Tyumen region doubled following the 1960s and 1970s boom. New cities were built in environmentally difficult conditions. In the future these cities will experience considerable social problems, especially as oil and gas companies operating in market conditions rationalize their labour force and rates of unemployment rise.

The narrow resource-based economy is a major source of economic vulnerability and instability in the Arctic region. Not diversifying economically reduces the chance of offsetting fluctuations in one direction by some exports with counter-fluctuations or stability in others. Economic fluctuations caused by a narrow resource base must be viewed as undesirable when they serve no useful purpose but to trigger fluctuations in other variables such as government revenues and investments, which impact short term economic stability and long term economic development. Sporadic deviations from some normal level of earnings associated with resource exports are likely to be a greater cause of concern as opposed to regularly reversing deviations. Predictable or certain events do not necessarily have adverse consequences since regularly reversing fluctuations make it easier to predict the level of exports and income each year and judge the correct timing for implementing necessary stabilization policies.

Other challenges include the *Dutch disease* phenomenon, an economic concept that tries to explain the apparent relationship between exploitation of natural resources and a decline in the manufacturing sector. The theory contends that an increase in revenues from natural resources will de-industrialize a nation's economy by raising the monetary

exchange rate, which makes the manufacturing sector less competitive and public services entangled with business interests. However, it is extremely difficult to definitively say that *Dutch disease* is the cause of a potentially decreasing manufacturing sector since there are many other factors at play.

A key consideration is the potential for environmental damage from oil and gas activities because one of the most prevalent sources of environmental damage in the world today is petroleum-derived contaminants. Perhaps the most visible sources of petroleum pollution are the catastrophic oil-tanker spills like the 1989 Exxon Valdez spill in Alaska. These spills occur while transporting crude oil long distances by ocean tanker and pipelines, which makes the oil industry prone to accidents. Oil spills at the site of extraction are also possible. Spills release massive quantities of petroleum into land and marine eco-systems. The majority of oil pollution occurs over long periods as small spills accumulate into large effects. Despite advances in technology and regulatory processes, oil spills are not uncommon and environmental impacts and socio-economic consequences cannot be ignored. While the industry causes extensive impacts on the environment, more widespread understanding of environmental impacts today (e.g. oil spills, pipeline leaks, improved technology, increased regulation of the industry) have reduced impacts witnessed in the industry.

Learning Activity 2

What are the potential socio-economic costs and benefits from industrial production in your region?

Learning Highlight 3

A variety of socio-economic factors are required to help facilitate the development of oil and gas resources. The net-benefit to local communities from resource development depends among other things on resource ownership and control.

6.5 Developing Oil and Gas Resources in the North: Financial Considerations

The primary factors that distinguish northern oil and gas resources from those of other regions are the difficult natural and environmental conditions in which they are found. Ocean wells are located in deep seas that are frozen for long periods. Drilling platforms on land are located on continuous permafrost and environmentally fragile lands.

The difference between the market value of the extracted oil and the costs of exploration, development and extraction including a normal rate of return for capital, labour and materials is known as a resource rent. This economic rent is usually the target of special petroleum taxation. The economic rent can be seen as the difference between accounting profits and the return on investment required to attract new capital and keep the industry going. Economic rent is the profit above and beyond the cost of capital investments.

The division of economic rent between the government-landowner and the company investing in oil extraction is subject to bargaining specific to each situation and determined by field size and the state of the market. Fiscal measures used take the form of royalties, excise taxes or taxes on economic rent. Excise taxes represent a cost element contributing to a base value below which the

market value of oil does not fall. Rises and declines of economic rent strongly affect the level of profit and ability of governments to tax. In the pre-maturity and maturity phases, profits rise quickly followed by tax increases. Governments also often require a high degree of state participation. In many cases, a government's objective is to develop a large oil service industry and use oil wealth for industrial policy purposes. As maturity advances, especially in the post-maturity phase, economic rents subside particularly in new prospects. Declining profits force governments to reduce tax levels to maintain exploration and development. In late maturity and post-maturity, the oil industry mimics ordinary industry in its return on investment and in terms of its treatment by government.

Learning Activity 2

What are the potential environmental costs of industrial extraction in your region?

For Northern regions royalties from the sale of oil and gas are a fundamental source of income for economic diversification, building infrastructure and creating new employment. Collection and accumulation of royalties differs in regional and municipal budgets. The *unitary model* of collection and accumulation of royalties is characteristic in Norway while the Canadian Northern Territories and Alaska are characterized by a liberal model. The *unitary model* proposes centralized accumulation of royalty revenues in the state budget. A portion of royalty revenues is then transferred to regions in the form of transfer payments. By contrast, the Liberal model proposes territories immediately receive royalty revenues upon payment. Therefore, royalty revenues are paid directly to First Nations bands or municipalities. Russia's system falls between the Unitary and Liberal models. Regions receive substantially more revenue than in Soviet times when the system of revenue collection was highly centralized. However, due to practices such as transfer pricing (tolling) and the fact that the federal government collects a large portion of royalty revenues, oil producing regions such as the Yamalo-Nenetsky, Khanty-Mansiysky, Nenetsky Autonomus Okrugs and the Komi Republic have not received colossal sums owed to them. The absence of such sums has restricted the ability of Russia's northern regions to engage in economic diversification and create new employment opportunities. Northern regions of Russia are not in a position to control and manage their economic futures as is the case in Alaska and northern Canada.

6.5.1 Climate Change and Financial Considerations

Climate change in the Arctic means warmer temperatures, melting permafrost, changes in precipitation and the extent of snow and ice. These changes mean some economic activities will become more profitable while others will incur more costs or become financially non-viable.

Oil and gas activities depend on the environment and are sensitive to changes in climate. The Arctic region produces about ten percent of the world's oil and twenty percent of its gas. This production is expected to increase in the future. The economic impacts of climate change on the petroleum industry will depend on whether the petroleum activity is on- or off-shore. In the case of onshore oil and gas exploration and production, financial considerations include increased transportation costs due to thawing permafrost

making it more difficult to transport heavy equipment on ground and the possible destabilization of infrastructure and pipelines. Offshore exploration and production may lead to cost reductions with thinning sea ice and increased accessibility, although expected increase in sea waves, icebergs and ice movements may necessitate investment in new equipment.

Conclusion

Future petroleum production in the Arctic will involve offshore investments. The petroleum industry has not been paying attention to offshore activities in northern waters for more than a decade. The strategy was initially built around massive platforms that could withstand icebergs. Now the industry sees new and better opportunities in smaller and more mobile units that can avoid collisions with icebergs. The harsh environment poses special demands on technology, which is reflected in supply costs. Exploration wells drilled from vessels specially designed for icy waters are expensive. Total supply costs are between three and five times the cost of similar projects in temperate locations.

One can speculate on possible changes in the future demand for oil and gas. The world's reliance on petroleum is expected to grow despite widespread environmental, economic and political consequences. Increased pressure may be placed on achieving sustainable development in non-renewable resource based economies to meet current needs without compromising future generations. There are compelling reasons to work towards decreasing society's dependence on petroleum for energy. Energy-efficient engines and electric cars can help to reduce the need for oil. There are a variety of alternative fuels all based on plentiful renewable resources such as biodiesel and hydrogen that produce little or no exhaust pollutants or greenhouse gases.

Discussion Questions

1. In what ways have socio-economic impacts of non-renewable resource extraction changed in the North and what have been the driving factors?
2. To what extent is sustainable development possible in a region economically dependent on non-renewable resources?

Study Questions and Answers

1. What is the role of the primary resource sector in the North?
2. What is the structure of the oil and gas industry in Russia?
3. What are some of the risks associated with developing an oil economy?
4. Outline some of the negative impacts associated with oil extraction.
5. What are the financial considerations of developing oil and gas resources?

Glossary of Terms

Alaska Oil Funds: The Alaska Permanent Fund, established in 1976, created to be an investment for at least 25 percent of proceeds from mineral sales or royalties. The Fund sets aside a share of oil revenues to benefit current and future generations of Alaskans.

Capital Intensive Production: Production that uses relatively more capital (i.e., machinery and equipment) in production than labour and other factor inputs.

Dutch Disease Phenomenon: A concept that attempts to explain the adverse effect on a country's other industries that occur when one industry substantially expands its exports resulting in an appreciation of the currency and a decline in manufacturing.

Economic Diversification: Expanding into new types of business. Spreading risk by increasing the number of resources or economic activities that generate regional income.

Economic Rent: A surplus value after all costs and normal investment have been accounted for.

Economies of Scale: When increasing the scale of production leads to lower cost per unit of output produced.

Economic Linkages: Connections between firms. Backward linkage is when a firm buys input for production from another firm. A forward linkage is when a firm sells to another firm.

Gross Domestic Product (GDP): Total value of all final goods and services produced in a country in a given year.

Multinational Corporation: International corporation that operates in more than one country.

Oligopoly: A market structure described by significant market dominance by few firms that make up a significant share of the overall market and where barriers are erected against entry of new firms.

Primary Exports: Export of primary products (e.g., foodstuffs, lumber, mining and quarrying, raw materials).

Royalties: Compensation for the use of property (e.g., a natural resource). A petroleum company negotiates a royalty agreement with the owners of mineral rights. If oil is found the owner of the mineral rights will be paid royalties based on barrels of oil pumped.

Social Cost: Cost of an economic decision, whether private or public, to society as a whole.

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their needs.

Sunk Costs: Costs that cannot be recouped (e.g., that cannot be transferred to another project or asset after a project has ended).

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