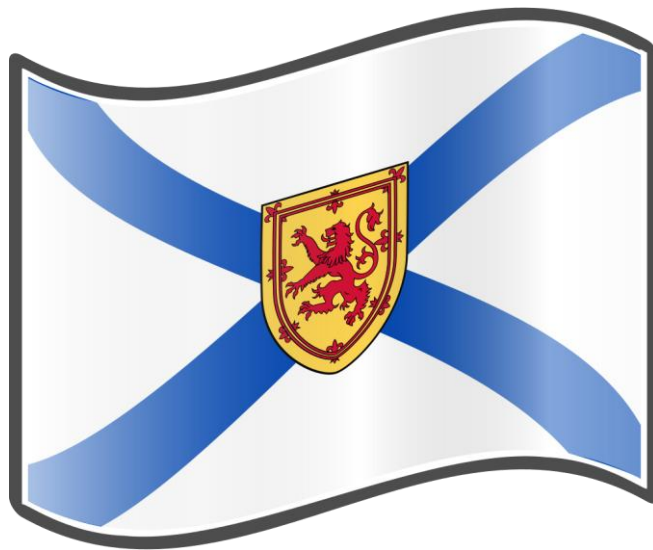


**NOVA SCOTIA**  
**DEPARTMENT OF ENERGY**

**EXPORT MARKET ANALYSIS**  
**MARCH 2017**





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# EXECUTIVE SUMMARY

Nova Scotia Department of Energy (NSDOE) is mandated to investigate economic opportunities for Nova Scotia technology developers and supply chain service providers. To assist the energy industry, NSDOE commissioned a global market analysis of the energy sectors of World Energy Cities Partnership (WECP) member countries. The following cities/countries of the WECP were included in this analysis: Cape Town (South Africa), Luanda (Angola), Calgary (Canada), Halifax (Canada), St. John's (Canada), Villahermosa (Mexico), Atyrau (Kazakhstan), Dammam (Saudi Arabia), Daqing (China), Doha (Qatar), Karamay (China), Kuala Lumpur (Malaysia), Aberdeen (Scotland), Esbjerg (Denmark), Stavanger (Norway), Perth (Australia) and Houston (USA).

The purpose of this analysis is to prepare and inform Nova Scotia companies of export opportunities in these countries, and maximize the relationships of upcoming trade events in Halifax and abroad. These events include: Offshore Technology Conference (OTC 2017); May 1-4, Houston, Texas; the European Wave and Tidal Energy Conference (EWTEC 2017), Aug. 27-Sept. 2, Cork, Ireland; and Offshore Europe 2017 – Sept. 5-8, Aberdeen, Scotland.

The final events will be held in October 2017 in Halifax. The World Energy City Partnership (WECP) annual general meeting will be hosted simultaneously with the Maritime Energy Association's (MEA) 35th anniversary Core Energy Conference. The WECP steering committee will be bringing a delegation of companies to Halifax to participate in both events. The country profiles in this analysis will

prepare Nova Scotian companies by describing best prospects, partnerships and technology transfer opportunities with WECP participating companies. WECP companies, in turn, will be educated on opportunities, sales and foreign direct investment in Canada.

From the market profiles, several themes are prevalent across the globe:

- Fossil fuels will continue to play a significant role in the global energy mix.
- All countries have made a commitment to reduce greenhouse gas emissions (GHG) by increasing their energy production from renewable resources. To achieve these goals, all countries will need to invest their own money and find private investors to advance innovation, technology and infrastructure to cost effectively bring renewable energy to the grid.
- International oil companies and governments were affected financially by the volatile oil prices. Some countries, whose energy consumption relies on other forms of energy such as Australia and Qatar, were more insulated.
- International oil companies and operators in the supply chain incurred heavy employee layoffs.
- Several international oil companies merged and consolidated with other companies and/or sold assets.
- New exploration was delayed in favour of life extension of existing proved fields.

- Although, all but one country is experiencing a turnaround in oil and gas exploration, production is still in decline.
- New technology in both products and services are desperately needed to effectively and efficiently manage both upstream and downstream operations.
- New technologies are needed in renewable energy for it to be more cost effective over oil, LNG or coal power.

The information presented in this report was sourced from the specified country's government and trade association websites, trade and industry reports from the US and the UK government, published research reports, news articles and primary in-country contacts.

The oil and gas industry is forever changing and best prospects for Nova Scotia companies are based on global and local perspectives. Ranking of countries based on opportunities for Nova Scotia's energy services sector may be difficult as providers are varied and the level of export preparedness is also diverse. Much of Nova Scotia's strengths are in subsea technology and services. However, if industry is to grow and expand, companies need to acquire the latest innovations. This could include acquiring technology or partnering with external firms to reach new markets. For SMEs, most often the best way to first enter a market is to partner with another company. The partner should have a new set of skills and product offerings to make a stronger co-venture. Another method is to sell to or partner with a company that is already doing business in the market. This is especially true for mature and heavily competitive markets with established companies such as Malaysia. As well, working with a market distributor or agent will be useful (and in most cases required) for countries where Nova Scotian companies lack

the experience of working in foreign languages, country regulations and working with government officials.

Today's political climate may also be favourable for Nova Scotian companies. Mexico could be a good market for Canada because of the political tensions with the US, and potential changes to NAFTA. Additionally, the Brazilian government is lowering its local content rules to attract foreign investors. South Africa is considered a frontier market by oil and gas companies, yet Nova Scotia companies may find niche opportunities here and less competition from other international companies. In renewable energy, Saudi Arabia is issuing requests for proposals in April 2017, with billions in financial backing. International renewable energy companies are closely following developments in Saudi Arabia. Australia, however, may be the prospect with the least potential for Nova Scotia, due not only its proximity, but the market slow down. Australia, nonetheless, is a leader in LNG exports, a gateway to Asian countries. These factors all offer opportunities for Nova Scotian companies.

Nova Scotia is emerging as a leader in the global tidal energy industry and is home to Canada's leading test site for in-stream tidal energy devices, the Fundy Ocean Research Center for Energy (FORCE). In 2016, Cape Sharp Tidal deployed the largest in-stream tidal turbine (2 MW) and there are future plans to deploy more turbines in the Bay of Fundy. Nova Scotian innovation in tidal energy will create opportunities for investment and will advance the technological development of related supplies and services. Australia and Denmark are in the infancy stages of tidal energy research. These countries may be an attractive market for exports for Nova Scotia companies involved in tidal energy.

In other areas of renewable energy, Nova Scotia also has the opportunity for technology transfer from WECP member countries. Denmark is a leader in biomass and wind energy, and Norway is leading the world in battery operated marine vessels. Nova Scotia companies have a unique opportunity to investigate these technologies to transfer to not only this country, but to re-export new skill sets globally.

Nova Scotia companies need to research their market, funding programs and create an entrance strategy before entering a new market. Strategies may include working with the NSDOE, Halifax Partnership, the Atlantic Canada Opportunities Agency (ACOA), Global Affairs Canada, Export Development Canada, and the Maritimes Energy Association, Offshore Energy Research Association, Marine Renewables Canada and other relevant trade associations in Nova Scotia and Canada.

Abbreviations:

AO	Angola
AU	Australia
BR	Brazil
CA	Canada
CN	China
DK	Denmark
KZ	Kazakhstan
MY	Malaysia
MX	Mexico
NO	Norway
QA	Qatar
SA	Saudi Arabia
ZA	South Africa
UK	United Kingdom
USA	United States of America
EDC	Export Development Canada
WECP	World Energy City Partnership

Contents Clip Art: Courtesy of WECP

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**The information compiled in this report took place in March 2017 with updates mostly in April 2017.**

[www.dugganinternational.ca](http://www.dugganinternational.ca)

**“BEST PROSPECTS” CHARTS**

The following charts summarize the “Best Prospects” and opportunities for Nova Scotia companies in the WECP countries. Categories established were based on the analysis of the best prospects research within each country profile.

	AO	AU	BR	CA	CN	DK	KZ	MY	MX	NO	QA	SA	ZA	UK	USA
<b>OFFSHORE</b>															
Cost Saving Asset & Data Management	○						○		○				○	○	
Crewing Personnel			○			○									
Decommissioning Services		○		○										○	
Energy efficient technology & equipment	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Enhanced Oil Recovery (EOR) technology/field life extension	○	○				○		○	○	○	○		○	○	
Environmental Services & Chemical Disposal		○				○	○		○			○			
Fabrication						○									
FEED Front End Engineering & Design									○						○
Flow measurement Equip			○												
Maintenance, Repair, Operations (MRO)		○	○	○			○			○	○	○			○
New Drilling Technology	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Oil Field Services and Equipment (OFSE) operations		○	○		○			○				○			○

	AO	AU	BR	CA	CN	DK	KZ	MY	MX	NO	QA	SA	ZA	UK	USA
<b>OFFSHORE</b>															
Oil Spill Clean Up Technologies							○					○			
Pipeline Design												○			
Process Management Software							○			○				○	
Project Management									○						
Safety training/ niche education									○		○	○	○		
Ship Building Services & Equipment			○												
Shipping Logistics & Warehousing						○								○	
Subsea Engineering & Tech	○		○		○	○			○	○			○		
Surveys - Seismic Processing and Interpretation	○						○		○	○			○		
Vessel Management		○													
Well Abandonment Expertise		○	○											○	

	AO	AU	BR	CA	CN	DK	KZ	MY	MX	NO	QA	SA	ZA	UK	USA
<b>ONSHORE</b>															
Cost reduction services & tech				○			○						○		
Engineering Services							○								
Environment Assessments & Remediation				○								○	○		○
Gas Extraction Consulting Services													○		
Horizontal Drilling Expertise		○		○	○	○							○		
LNG facilities O&M		○		○											○
Logistics and Transportation		○													
Mining Equipment				○											
MRO				○									○		○
New tech for field maintenance & life extension				○			○								
New technologies for drilling				○	○		○						○		
Pipeline services				○			○								○
Safety & Security Equipment				○								○			○

These countries are all involved with most areas of development in upstream and downstream energy. Many of these markets are well established and have international and domestic companies dominating the industry.

This research was conducted between March 1-18, 2017, with updates mostly in April 2017. Readers will note that country requirements and project needs will change on a regular basis, as well as new project announcements.



	AO	AU	BR	CA	CN	DK	KZ	MY	MX	NO	QA	SA	ZA	UK	USA
<b>RENEWABLE</b>															
Battery Power				○											
Biomass Consulting				○	○	○	○	○	○			○	○		
Energy Storage Solutions		○												○	
Engineering Services	○			○			○								○
Environment Impact Analysis & Surveys	○		○						○						○
Geophysical. Meteorological Surveys, Resource Mapping			○											○	○
HVAC Cooling Equipment											○				
Hydropower Consulting					○										○
Hydropower Water Mgmt Consulting		○	○												○
LED Lights								○							
Metering & Monitoring	○			○					○	○					
MRO						○					○	○		○	○
Navigational Aids & Subsea Equipment														○	○
New Infrastructure Mgmt Software		○												○	
Public Education Campaigns	○								○						
Smart Grid Management		○												○	
Solar Power Consulting				○					○		○	○	○		
Tidal & Wave Consulting		○		○		○									○
Training and Education for Industry											○				
Wind & Hydro Equipment				○	○		○		○					○	○
Wind Power Consulting				○	○		○		○	○	○	○	○		
Wind Turbine Design			○	○	○		○								

# ANGOLA



## Country Facts

Nominal GDP	109.30 Billion USD
Population	25.02 Million
Total Trade/GDP	78.36%
Currency	Angolan Kwanza (AOA)
Merchandise Imports from Canada	69.64 Million CAD
Main imports	Consumer Goods, Chemicals, Intermediate Goods

## ANGOLA COUNTRY PROFILE

### OVERVIEW

The economic foundation of Angola is the oil and gas industry. The country is the second largest oil and gas producer in the region, making it the third largest economy in Sub-Saharan Africa. The Angolan economy is growing, even though resource prices have been low and the country has halted some development projects.

Angola's renewable energy sector is mainly dependent on solar power then hydropower. The country has ambitious goals to increase renewable energy production over the next 10 years.

Portuguese is the official language and it is important to have this resource for doing business. Angola achieved its independence from Portugal in 1975, and then entered into a civil war that ended in 2002.

Figure 1 Source: EDC

### COUNTRY SOURCES OF ENERGY

In 2013, the US government reported that Angola's energy consumption were from the following sources: biomass 52%, oil 43%, gas 2% and hydroelectric power 4 percent.

Angola suffers from poor infrastructure with only 20-30% of the population having access to electricity. The system is subject to frequent power cuts and for that reason; there is a high dependency on oil run generators.<sup>1</sup>

The Angolan national grid currently sources 43% of its electricity from hydropower (950 MW) and 57% from thermal (diesel) sources (1,250 MW). Almost one-half of the country's electric power produced (900-1000MW) serves the capital city Luanda.

The power framework in Angola is comprised of three major independent grid systems. These

<sup>1</sup> <https://www.gov.uk/government/publications/exporting-to-angola/doing-business-in-angola-angola-trade-and-export-guide>

grids however are not yet integrated. Angola is currently a non-operating member of the Southern African Power Pool, but plans to connect to the pool through Namibia (Baynes) and the Democratic Republic of Congo (Inga). Commercial and technical losses are substantial because of not being integrated, and considerable portions of the customer base in Angola are not yet metered<sup>2</sup>.

Angola hopes to invest US\$16 billion<sup>3</sup> on improving the power sector, which includes renewable energy. Included in these plans is the construction of new power stations and generating units.

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

In June 2016, Isabel dos Santos, the eldest daughter of President José Eduardo dos Santos was appointed as chairwoman of state-owned oil and gas company, Sonangol. There is currently an appeal with the Constitutional Court on the basis of nepotism and an illegal appointment. Nonetheless, she remains at the helm of the company and is spearheading the restructuring of Sonangol. The company accounts for 90% of the country's foreign income.

The country also has hydro projects underway. Hydropower production is targeted to become 62% of Angola's energy mix. The government is also increasing small-scale off-grid production leveraging thermal as well as renewable technologies in solar, wind and biofuels.

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<sup>2</sup> <https://www.export.gov/article?id=Angola-Electric-Power-Generation>

<sup>3</sup> <https://www.gov.uk/government/publications/exporting-to-angola/doing-business-in-angola-angola-trade-and-export-guide>

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## **ENERGY INDUSTRY**

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### **OIL AND GAS**

Angola's oil and gas industry relies on imports for its supply chain. Even though local manufacturers and service companies have progressed significantly in the past years, they are not yet at the point where they can provide all the goods and services the industry requires.

Sonangol is currently a shareholder in almost all oil and natural gas production and exploration projects in Angola, with the exception of some deepwater projects. Sonangol also operates Angola's only oil refinery. The company owns 17 subsidiaries involved in exploration, production and marketing of crude oil, storage, and marketing of petroleum derivatives.

Sonangol's key subsidiaries are: Sonangol Pesquisa e Produção (P&P), which undertakes exploration and production activities; Sonaref, which runs refining operations; and Sonangás, which runs Angola's natural gas sector.

In 2016, Sonangol's output reportedly slipped to 1.7 million barrels a day. Analysts predicted that at this rate, by 2021 output will be 1.5 million barrels.

Historically, Angola's oil production grew by an annual average of 15% from 2002 to 2008, as production started in several deepwater fields. The first deepwater field to come online was the Chevron-operated Kuito field (Block 14) in late 1999.

Since then, international oil companies (IOCs) led by Total, Chevron, ExxonMobil, and BP have production at additional deepwater fields and are in the process of developing new ones.

As well, the potential of onshore oil production will remain an important factor in the coming

years. Many local operators are in the onshore. Ten blocks were auctioned off with seven located in the Kwanza Basin and the remainder in the Lower Congo Basin.

## Natural Gas

Angola currently produces small quantities of marketed natural gas, but the vast majority of the country's gross production is flared (burned off) or re-injected into oil wells.

In June 2013, Angola exported its first cargo of liquefied natural gas (LNG) to Brazil from its new LNG plant, the Combined Cycle Power Plant, in Soyo. The plant, often referred to just as "Soyo", was fully fed with associated gas, a released byproduct during oil production. Unfortunately, due to chronic technical issues, the plant shut down a year later. It is expected to reopen in 2017 (reports also had it opening in 2016). This plant will include several substations and transmission lines. It will produce 750 megawatts of electricity, giving it the ability to supply much of the country's energy requirements.<sup>4</sup>

### Other recent developments:

According to consultants Rystad Energy, the gas discovery in Angola's offshore Kwanza basin won't be developed before the end of the next decade. Sonangol had revealed the find in June 2016 and announced that the discovery in Block 20/11 held an estimated 313 million barrels of condensate and 2.8 trillion cubic feet of gas.

The reason for the delay in the development of this discovery is partially due to problems surrounding the ownership of the block. Cobalt International Energy operated stake in Blocks 20

and 21 and tried to sell the blocks to Sonangol. The deal was eventually terminated due to the fall in oil prices and Sonangol's failed attempt to restructure ownership of some other properties.

Development plans for Block 20 are also dependent on existing sales agreements. Much larger and developed projects in Eastern Africa, Eastern Mediterranean and Mauritania/Senegal have pushed the infrastructural challenged Angola to the end of the queue for commercialization.

Cobalt Energy International (CIE) also has successful finds at blocks: Cameia, Mavinga and Bicuar in Block 21 and Orca and Lontra in Block 20.

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## PROJECTS

Several oil projects are scheduled to start production in Angola, but the start dates may depend on the current oil price environment. The latest projects to come online were the CLOV (Cravo, Lirio, Orquidea, and Violeta), the West Hub development, the Kizomba Satellites Phase 2, and the Lianzi field. CLOV, operated by Total, started commercial production in June 2014. CLOV's production capacity is 160,000 b/d.

- The West Hub development, operated by Eni, started commercial production in December 2014. The West Hub's production capacity is 100,000 b/d. The Kizomba Satellites Phase 2, operated by a subsidiary of ExxonMobil, started production in May 2015. The project included the development of the Kakocha, Bavuca, and Mondo South fields with a total capacity of 70,000 b/d.
- The Lianzi field, operated by Chevron, started production in November 2015 and is expected to reach 40,000 b/d. The Lizani field is located in an offshore zone between Angola and the Republic of

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<sup>4</sup> <http://www.macauhub.com.mo/en/2016/03/23/combined-cycle-power-plant-project-in-soyo-angola-expected-to-cost-us900-million/>

Congo (Brazzaville). It is the first cross-border development of its kind in the region.

Angola has at least eight offshore and deepwater oil projects projected to come online within the next 5 to 10 years. Of those planned projects, three have received a final investment decision (FID) to develop the project.

### MAJOR COMPANIES

Chevron  
Exxon Mobil  
BP  
Sonangol

Leading players in Angola's energy sector include engineering and construction firms from:

- Portugal (Mota- Engil, Empreiteiros Casais, Edifer)
- Brazil (Odebrecht and Andrade Gutierres)
- China (China Genhouba Group Corp, China Machinery Engineering Corporation)
- Angolan companies (OPAIA, Ambergol)

To facilitate the engagement of local suppliers in any bidding process, the Ministry of Industry annually publishes a list of domestic suppliers of goods used in oil activities, and the Chamber of Commerce and Industry publishes a list of service providers contracted by oil operators (Ministry of Petroleum 2003).

<http://www.angolachamber.org/>

Some local companies include Test Angola, Prodiaman, Paragon Angola, Grupo Mieres Oil and Gas Consultants, and Angola LNG.

The Angolan Ministry of Petroleum and the National Oil Company (Sonangol) are the agencies in charge of implementing the Angolanization Plan (the employment of the people of Angola). Each agency has a dedicated directorate dealing with local content. The Ministry of Petroleum is in charge of regulation of the oil and gas industry. Sonangol acts as the implementation agency for the Ministry. The independence of Sonangol has been questioned by many industry players for potential conflict of interest since they are partners in the petroleum agreements and congruently performing a regulatory function.

Sonagás is tasked with the exploration, evaluation, production, storage, and transport of Angola's natural gas and natural gas derivatives. Sonangás is working with Sonangol P&P to establish a regulatory environment, including taxation, to help spur research and development in the natural gas sector.

Portuguese equipment and service provider Efacec Power Solutions, manufacturer of transformers and high tension equipment, holds a growing role in the Angolan power market. In 2015 the Angolan Electricity Distribution Company (ENDE) in a consortium with Angolan company Winterfell acquired a 65% share of Efacec Power Solutions.

The Angolization Policy for preferential treatment was passed by the National Assembly in 2003. Preferential treatment must be given to national private companies in the petroleum sector. IOCs operating in Angola are supposed to have a 70% Angolan workforce. Logistics and catering workers are also covered under this policy.

Additionally, IOCs are required to use Angolan banks for all their transactions.

Lastly, IOCs are expected to fund training programs by providing US\$200,000 per year per block during the exploration phase of their operations and \$0.15 per barrel of oil during the production phase. These expenses are tax deductible.

Local content regulations are designed to improve the technical and financial capacity of Sonangol, its subsidiaries, and the people of Angola. Noncompliance by IOCs could result in cancellation of the IOC's contract. In addition, the Ministry of Petroleum could impose monetary fines for every percentage point missed from the target.

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## **CERTIFICATION AND STANDARDS**

There are no particular certifications for working in Angola other than normal offshore and onshore safety training and certification required in other countries.

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## **WORKING IN ANGOLA**

Market Strengths:

- The economy has had an average double-digit growth since 1990
- A growing middle class
- A young population (50% under 21) who are eager to learn
- Abundant natural resources

The legal system in Angola is reputedly weak and fragmented. It is based on the Portuguese and Customary Law System. Understanding the system is difficult and laws change on a regular basis.

Market Challenges:

- Poor power supply nationwide

- Weak infrastructures across most sectors
- Government bureaucracy when awarding and paying for contracts
- Corruption
- High unemployment
- Lack of skills amongst the populace

A non-resident employee can only enter into employment agreements with a minimum term of three months and a maximum of 36 months. Foreign non-resident employees (expatriates) may only be hired when Angolan employees, with comparable qualifications and experience, are unavailable. Foreign non-resident individuals who go to Angola to work under the employment of a third party are legally required to secure a work visa prior to the commencement of work. Canadians must present a passport to visit Angola, which must be valid for at least six months beyond the date of expected departure. Whether visiting or working, Canadians must obtain a visa while still in Canada. The visa requires a criminal clearance and must be submitted in both English and Portuguese. The Portuguese copy must be notarized.

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Angola is responsible for coordinating energy policy for the Southern African Development Coordination Conference (SADCC) and SADCC's energy secretariat is based in World Energy City Partnership member Luanda.

Opportunities for Nova Scotia companies include exporting in the supply chain for:

- Oil and gas supplies
- Generation infrastructure, mainly based on water resources and natural gas

- Renewable energy technologies
- Implementing energy metering and monitoring systems

Categories with fewer than 50% of Angolan workers could present opportunities for Nova Scotia.

Best Prospects:

- Marine operations – downstream
- Subsea Engineering
- Surveying

## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

In 2014, a sharp drop in government revenues sent Angola’s currency into a free-fall, losing nearly 40% of its value until March 2016. In February 2016, inflation soared to a five-year high of just more than 20 percent.

Angola depends largely on the off-shore petroleum industry for 50% of GDP and 75% of government revenues. The economy is projected to begin a recovery in 2017, according to the IMF.

Also affected was the purchasing power of companies. With the weakened currency, companies were limited to what they could afford to import and to pay salaries.<sup>5</sup>

However, despite the drop in global oil prices, projects that are past the FID stage will not be canceled because the procurement and construction phase has already started.<sup>6</sup> What this means, is that project start times could be delayed if global crude oil prices remain low.

Several of Angola’s deepwater fields are past their peak production. The new capacity

additions from the upcoming projects are more likely to sustain Angola’s crude oil production at, or slightly above, current levels over the medium term rather than provide a substantial boost.

On the brighter side, Angola’s hydrocarbons industry, gas production and onshore development remain full of potential, with room for growth and expansion. Though current circumstances in the oil and gas industry are not optimal, attractive investment opportunities are still there.<sup>7</sup>

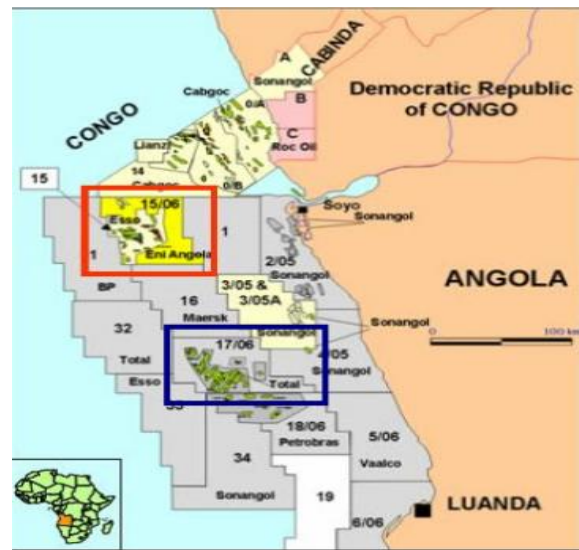


Figure 2 Angola Offshore Map Source: Offshore Energy.com

## RENEWABLE INDUSTRY

There are 367 solar projects; 100 small hydro projects; 42 biomass projects and 13 wind projects.

- Solar energy is the biggest renewable source of Angola, and it is more evenly distributed throughout the country. More than 17 GW of potential were

<sup>5</sup> <http://www.howwemadeitinafrica.com/risk-and-reward/>

<sup>6</sup> US Energy Information Administration

<sup>7</sup> <http://www.theoilandgasyear.com/interviews/angolas-emphasis-on-investment/>

mapped and studied, corresponding to more than 360 solar projects.

- Hydropower is reportedly the most competitive energy, with small hydro projects presenting cost of energy from 20 USD/MWh. From an overall potential of 18GW, 600MW of small hydro studied.
- Biomass projects, with total projects potential of more than 1.5 GW, have higher energy costs, starting at 75 USD/MWh, but biomass has high benefits in local job creation, particularly related to the process of extraction and management of biomass forest.
- Angola is also using municipal solid waste to produce energy in major urban areas.
- Wind power is not as prevalent in Angola as other WECP countries. It has about 600 MW of projects with good potential and competitive energy costs.
- The government announced that natural gas is targeted to meet 21% of Angola's energy demand by 2025. Mapping studies completed by the Ministry of Energy and Water in June 2014 identified potential for 55GW solar power, 3GW wind power and 18GW in hydropower throughout the country.

### **Company Involvement**

Andritz, an Austrian company, was awarded a contract to supply electromechanical equipment for the 2.1 GW Lauca hydropower plant in Angola.

The Chinese government financing to Angola includes a US\$980 million for the 750MW thermal combined cycle plant under

construction in Soyo with construction led by China Machinery Engineering Corporation (CMEC) and a pending \$4.5 billion loan to fund the Caculo Cabaça hydropower project.

GE is also providing substantial power production equipment for the Soyo project.

The Brazilian Development Bank (BNDES) finances many of the Brazilian goods and services used at the Laúca hydroelectric dam with Brazilian construction firm Odebrecht as the primary contractor. Meanwhile, the US\$100 million rehabilitation and expansion of the Cambambe hydroelectric dam is being financed by a commercial banking syndicate.

Other companies include Vestas, SGS Angola Lda., Mactech UK, EREDA, Solar Turbines (Caterpillar).

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### **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Best Prospects:

- Monitoring systems for energy efficiency
- Development of awareness and educational campaigns
- Impact analysis studies
- Metering systems
- Engineering and research

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### **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

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#### **NATIONAL RENEWABLE ENERGY STRATEGY**

The Strategy's objective is to achieve universal access to electricity options that include renewable energy source and a reduction of production of costs. The Ministry of Energy and Water (MINEA), is responsible for overseeing the implementation of the strategy. The government



sees universal access to sustainable energy as key to the reduction of poverty in rural areas.

Goals include:

- Increase the national electrification rate by around 60% by 2025
- Increase installed production capacity by 9.900MW by 2025 using 66% water sources, 19% natural gas sources, 8% renewable energies, and 7% thermal energy

The National Development Plan and the Action Plan<sup>8</sup> for the sector recognized that it is critical that priorities and key projects be defined for a 2018-2025 timeframe. The Plan aims to keep in line with the goals and aspirations of Angola Strategy 2025 and the Electric Sector Transformation Process (PTSE).

The 2025 vision for the power sector is based upon the goal of meeting the country's needs. A strong growth of energy consumption is anticipated up until 2025, reaching a load of 7.2 GW, more than four times the present. This growth will result mainly from bringing power to 60% of the population, from the increase in residential consumption, growth of national wealth through the services sector and from the country's industrialization.

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## **FUNDING INCENTIVES**

Sonangol is mandated to grant local companies fiscal incentives including the exemption from or reduction of industrial, income, import, and other taxes; financial support in the form of subsidies, loans, promotional venture capital, access to agreed private management funds, and financial guarantees; and technical support and special rights privileges in awarding

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<sup>8</sup> [http://www.embangola-can.org/en/national\\_development\\_plan.html](http://www.embangola-can.org/en/national_development_plan.html)

concessions. Nova Scotia firms would have to joint venture with a local firm to access any of these incentives.

Angola's investment law gives foreign and domestic investors equal access to investment incentives. Incentives for such high-priority sectors as energy and water include exemption from industrial and capital gains taxes for up to 15 years and from customs duties for up to six years.

Many foreign companies now operating in Angola enjoy some form of tax or duty waiver. Companies need to apply for incentives when submitting an investment application to the Angolan Private National Investment Agency, ANIP.<sup>9</sup>

Other funding could be obtained by applying to the international banks. Development banks and countries have loaned money to Angola for renewable projects.

The African Development Bank's (AfDB) US\$1 billion loan to the Angolan government supports Angola's power sector restructuring process while providing technical assistance and capacity-building support. The loan focuses on enhancing power sector efficiency, fostering private sector investment especially in renewable energy, and improving public financial management transparency and procurement reform. To assist in implementation of the Electricity Law (June 2015) that allows for independent power production (IPPs), AfDB is now supporting the Ministry of Energy and Water and IRSE in establishing a regulatory framework to encourage private investments in Angola. No specific power production or

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<sup>9</sup> <http://www.howwemadeitinafrica.com/angola-business-and-investment-climate-overview/>

transmission projects are being funded by the AfDB.

To support power generation capacity throughout Sub-Saharan Africa, the U.S. Government launched the Power Africa initiative to leverage private sector and government resources to increase power generation in the region by 30,000 megawatts (MW). U.S. Government agencies including US Export-Import Bank, Overseas Private Investment Corporation, and US Trade and Development Agency are active players in Power Africa and prioritize energy-related project support in Africa. Details are available at: [www.usaid.gov/powerafrica](http://www.usaid.gov/powerafrica).

Funding is available to companies through other sources:

- The Renewable Energy Performance Platform (REPP)
- Global Climate Partnership Fund (GCPF)
- Impact Assets Emerging Markets Climate Fund

For full fund descriptions:  
<https://www.africa-eu-renewables.org/funding-database-2/>

Some of the funds are through European governments and/or managed by trade associations. Nova Scotia companies may need to partner with a European company for a better likelihood of success for obtaining support.

## NOTES:

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## OTHER SOURCES OF INFORMATION

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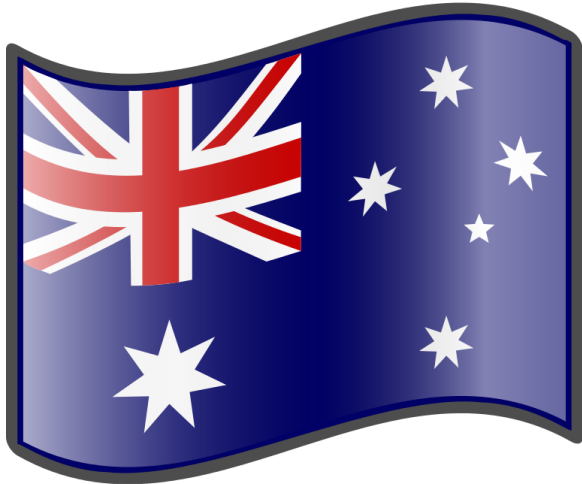
Analyst: Angolan Gas Discovery Has At Least Decade Before it Comes Online, December 2016  
[http://www.rigzone.com/news/oil\\_gas/a/147388/analyst\\_angolan\\_gas\\_discovery\\_has\\_at\\_least\\_decade\\_before\\_it\\_comes\\_online](http://www.rigzone.com/news/oil_gas/a/147388/analyst_angolan_gas_discovery_has_at_least_decade_before_it_comes_online)

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<http://www.howwemadeitinafrica.com/angola-diversifying-oil/>

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<https://www.gov.uk/government/publications/exporting-to-angola/doing-business-in-angola-angola-trade-and-export-guide>

# AUSTRALIA



## Country Facts

Nominal GDP	1,225.70 Billion USD
Population	23.90 Million
Total Trade/GDP	41.00%
Currency	Australian Dollar (AUD)
Merchandise Imports from Canada	1,890.30 Million CAD
Canadian direct investment	24,836 Million CAD
Main imports	Intermediate Goods, Food, Beverage & Tobacco, Capital Goods

## AUSTRALIA COUNTRY PROFILE

### OVERVIEW

Australia is the 4<sup>th</sup> largest economy in the Asia-Pacific region, and the 13<sup>th</sup> largest economy in the world. Australia's nominal GDP is estimated at US\$1.3 trillion and accounts for 1.7% of the global economy. The country has had 26 years of uninterrupted economic growth, mainly due to its mining boom.<sup>10</sup> Australia's GDP per capita at current exchange rates make its citizens among the world's top five wealthiest.

Australia is rich in hydrocarbons and uranium reserves. The country was the world's 2<sup>nd</sup> largest coal exporter in 2012 and the 3<sup>rd</sup> largest liquefied natural gas (LNG) exporter in 2013. Australia exports nearly 70% of its total energy production (excluding energy imports).

<sup>10</sup> Australian Trade and Investment Commission

Figure 3 Source: EDC

In 2016, the Australian Petroleum Production & Exploration Association (APPEA) stated that rising LNG exports are underpinning Australia's economic growth. AUD\$200 billion was invested in LNG projects, and they predict Australia will soon become the world's leading LNG exporter, with 60% of Australia's LNG coming from Western Australia.

Conversely, the continuing fall in petroleum exploration is alarming for the country's energy industry. Exploration is at its lowest level since 2006. Between 2010 and 2014 oil production in Australia declined 30% and exploration expenditure has fallen by 43 per cent.

Renewable energy sources are currently used for generating electricity, both on and off-grid, for residential heating and cooling, transport fuels, and in the manufacturing sector to produce heat.

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## COUNTRY SOURCES OF ENERGY

Oil remained the largest primary energy source in Australia, at 38% in 2014–15, followed by coal (32%) and natural gas (24%). Renewables accounted for 6% of Australia's energy mix.<sup>11</sup>

Total electricity generation was 252 terawatt hours (908 petajoules) in 2014–15, below the peak of 254 terawatt hours in 2010–11. Renewable energy accounted for 14% of Australia's total electricity generation in 2014–15, and is forecast to increase to 20% by 2034–35.

Most of the growth in energy use was for electricity generation, reflecting increased demand for electricity and a switch towards coal.

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## CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

The growth in energy consumption in Australia has generally remained below the rate of economic growth over the last 30 years. This can mainly be attributed to a shift in the economy towards less energy-intensive sectors. Hydropower fell by 27% because lack of available water. Wind and solar continued to grow, with wind now one-third of renewable generation in Australia and one-third of total generation in South Australia.

Coal remained the major fuel source for electricity generation in 2014–15, with its share in the fuel mix increasing to 63%, up from 61% in 2013–14. Imports of oil increased with 85% of refinery feedstock from imports.

The Australian government published the Energy White Paper in 2012. It outlined a policy to

balance securing domestic energy at affordable prices and increase exports to help supply Asia's growing demand for fuel. Both of these paths involve developing more energy infrastructure, attracting greater investment, creating efficient energy markets and pricing mechanisms for consumers, and delivering cleaner and more sustainable energy.

However, Australia's expanding energy industry has encountered escalating project costs and a labour shortage. Adding to this, many oil and gas companies have recently suspended offshore exploration. These factors are coupled with a bigger push for clean energy and stricter environmental regulations.

In 2016, industry and government met to discuss the future of the energy industry. Industry implored that government urgently needs to encourage investment to address gas supply challenges that are forecasted to occur between 2018 and 2024. The Australian Energy Market Operator highlighted that gas-fired generation must stay in the energy mix to protect the country's energy security.<sup>12</sup> From this meeting, gas producers agreed to make more gas available to the domestic market as soon as possible to keep downward pressure on prices. Producers committed to revise their domestic gas production forecasts, and two of the country's LNG exporters gave a commitment to domestic gas contributions, as part of their social licence. Lastly, to monitor and report on the progress of the industry's and government actions, the government is establishing a multi departmental taskforce.

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<sup>11</sup> <https://industry.gov.au/Office-of-the-Chief-Economist/Publications/Documents/aes/2015-australian-energy-statistics.pdf>

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<sup>12</sup> [https://www.appea.com.au/media\\_release/gas-industry-to-ensure-supply/](https://www.appea.com.au/media_release/gas-industry-to-ensure-supply/)

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## ENERGY INDUSTRY

### OIL AND GAS

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In 2017, the results from the latest rounds of bidding for offshore petroleum exploration in 2016 confirmed a deepening problem for Australia; there was only one bid, and that offshore exploration is in dire straits, even if the commodity prices are stronger. APPEA recommended that government get rid of unnecessary regulatory costs and time delays. APPEA implored that it is essential to maintain a stable, attractive policy environment in key areas such as tax and environmental regulation.<sup>13</sup>

Australia held more than 1.2 billion barrels of proved oil reserves as 2016. Geoscience Australia reported economic reserves of nearly 3.8 billion barrels, composed of 0.9 billion barrels crude oil, 1.9 billion barrels condensates, and 0.9 billion liquid petroleum gas (LPG). Most Australian crude oil is a light, sweet grade, typically low in sulfur and wax, and therefore higher in value than the heavier crudes.

The majority of reserves are located off the coasts of the states of Western Australia, Victoria, and the Northern Territory. Onshore basins, mostly found in the Cooper Basin, account for only 5% of the oil resources. Western Australia (including the Bonaparte Basin straddling Western Australia and Northern Territory) has 72% of the country's proved crude oil reserves, as well as 92% of its condensate and 79% of its LPG reserves. The two largest oil-producing basins are the Carnarvon Basin in Northwestern Australia and the Gippsland Basin in Southeastern Australia.

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<sup>13</sup> [https://www.appea.com.au/media\\_release/disturbing-exploration-decline-continues/](https://www.appea.com.au/media_release/disturbing-exploration-decline-continues/)

International oil companies dominate the country's oil and natural gas exploration and development. Chevron is the largest foreign oil producer, supplying 96,000 barrels per day (bbl/d) in 2013. Other international oil companies actively investing in Australia's upstream hydrocarbon developments include Shell, ExxonMobil, ConocoPhillips, Inpex (Japan), Total, BHP Billiton, and Quadrant Energy.

There are Australian companies as well, the largest being Woodside Petroleum and Santos. These companies focus on upstream oil and gas developments. Other smaller domestic players in both the upstream and downstream markets include Origin Energy and Beach Energy.

The final round of the 2016 Offshore Petroleum Exploration Acreage Release closed on March 23, 2017. The cash-bid auction was re-introduced in Australia in 2014 but hasn't until now resulted in any cash-bid permits being awarded. This latest cash-bid auction was held in February 2017. Two companies prequalified for the auction. As stated, at the close of the auction only one bid was received by Chevron Australia New Ventures.<sup>14</sup> The remaining cash bid awarded to Chevron for AUD\$3M.

Awarding the cash bid permit was to show that Australia remains an attractive petroleum exploration investment destination, outside of the traditional acreage release process. The cash bidding process is focused on mature areas where only minimal further exploration may be required.

The recent unfavorable economics have pressured refinery operators to close several

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<sup>14</sup> <http://www.oedigital.com/component/k2/item/14731-chevron-picks-up-new-australian-exploration-permit>

facilities and convert some of them to oil product import terminals. Australia has four remaining oil refineries which are small and dated compared to the larger and more complex refineries being built in Asia. These refineries, Lytton Caltex, Altona Mobil Geelong Vitol, Kwinana BP, have a total capacity of 453,000 bbls/day.

Shell announced the closure of Sydney's Clyde refinery in 2011, and Caltex did the same with its Sydney's Kurnell refinery a year later. When BP announced the closure of Queensland's Bulwer Island refinery in April 2014, Australia had slashed 42% of its refining capacity in the space in three years. Shell sold its Geelong refinery to oil trading company Vitol in 2014. Overall, these refinery closures represent about half of the capacity in operation a decade ago, and these closures have led to increases in the country's petroleum product imports, particularly for diesel, gasoline, and jet fuel.

### **Natural Gas**

Australia has become a leading LNG exporter to the Asia-Pacific region in the past decade. Greater than expected natural gas production and new LNG capacity in the next few years is also likely to boost natural gas exports. Natural gas production rose by 5% in 2014–15 to 2,607 petajoules (66 billion cubic metres). Western Australia remained Australia's largest producer of natural gas, producing nearly two-thirds of total gas production in 2014–15. Production of coal seam gas increased by 50% in 2014–15, to reach 462 petajoules (12 billion cubic metres), as new wells were drilled in Queensland to support the start of LNG exports from Gladstone.

However, the country has restrictions to onshore gas exploration. There is currently a total ban in

Victoria, as four applications for gas production in NSW remains under consideration since 2010.

### **Coal Bed Methane (CBM)**

Australia has sizeable, untapped natural gas resources in the form of coalbed methane (CBM), known as coal seam gas in Australia. Australian officials estimate that economically recoverable CBM reserves in 2012 were 33 Tcf. Coal seam gas accounted for 18% of Australian gas production on an energy content basis, and nearly half of east coast gas production.

Many CBM projects are still being explored, and production is not targeted for another few years. Investors face challenges with project delays based on greater public resistance to potential environmental impacts. Australia is attempting to balance its dual interests of increasing investment and exploitation of these resources as well as developing them in a sustainable and environmentally safe way.

NSW, Queensland, and the federal government have increased environmental regulations, particularly those related to water use and disposal and land rights in CBM and shale gas projects. Queensland established more austere water safety and management policies for CBM producers. In 2012, NSW replaced the moratorium it imposed in 2011 on hydraulic fracturing with a Strategic Regional Land Use Policy that restricts CBM production near residential areas and small industries.

### **Shale Gas**

Shale gas reserves in Australia are vast and could boost gas production. Australia has reportedly 437 Tcf of technically recoverable reserves, ranking the country 6<sup>th</sup> in the world. Shale extraction has attracted many international oil companies with financing and technical

capacities to develop the shale reserve. The shale gas sector is very much however in its infancy with a series of technical and geological challenges impacting the viability of production.

## Coal

Australia is the world's 2<sup>nd</sup> largest coal exporter, on a weight-basis, and coal ranks as the 2<sup>nd</sup> largest export commodity for Australia in terms of revenues. Black coal production increased by 4% in 2014–15 to reach 12,288 petajoules (447 million tonnes). After two years of decline, brown coal production increased in 2014–15, by 8% to 678 petajoules (65 million tonnes). Increased demand for brown coal fired electricity is due to the significant fall in hydropower.

The majority of Australia's coal production comes from open pit operations, with the remainder coming from underground mines. International companies such as BHP Billiton, Anglo American (UK), Rio Tinto (Australia-UK), and Xstrata (Switzerland) play a significant role in Australia's coal industry.

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## PROJECTS

- Japan's biggest oil and gas explorer Inpex Corp is moving forward with its plan to contract a huge LNG export plant in July-September 2017 called Ichthys. There was trouble over the completion of a power station and the Ichthys project was dealt a blow as engineering firm CIMIC - involved in building the facility's power station - announced it was pulling the plug. That led to many production delays.
- Senex Energy Ltd has lined up private equity firm EIG Global Energy Partners to provide up to AUD\$300 million to back a coal seam gas project. Australia's eastern states face a gas crunch. And from 2018, demand is set to triple to

feed LNG exports, while supply growth has been curbed by states opposed to onshore drilling.

- Chevron Corp temporarily halted output from one of the two production units at its Gorgon LNG plant off Australia's west coast. It marks the latest in a string of outages to hit the AUD\$54 billion project since it started up in March 2016. On March 28, 2017 Chevron started production from the third Gorgon gas train. Previously on December 9, 2016 Chevron announced an initial 150Tj/d of domestic gas commenced with a planned capacity of 300 Tj/d as demand increases.
- In February 2017 Chevron picked up a new exploration permit in a gas-rich part of the Carnarvon Basin, offshore Western Australia. Chevron paid AUD\$3 million for the cash bid permit WA-526-P for six years.
- Mitra Energy Inc. has confirmed that Jadestone Energy (Australia) Pty Ltd, a wholly owned subsidiary of Mitra, has closed the acquisition of the Stag oilfield, located offshore Western Australia. The Stag oilfield, which is situated in the Carnarvon Basin, has a production rate of around 3,468 barrels per day. This figure is expected to increase on the completion of two workovers planned as well as further increases with the infill wells.
- In 2016, BP Plc abandoned plans to drill for oil and gas off the south coast of Australia, saying it can get better value for its exploration spending elsewhere, although it still sees strong potential in the Great Australian Bight.

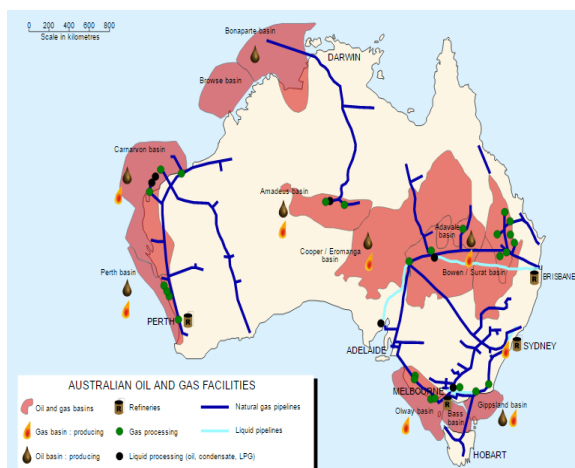


Figure 4 Oil and Gas Map Source: Wikipedia

## GOVERNMENT REGULATIONS AND POLICIES

There are no Australian government-owned resource companies and no requirement for government participation in resources projects.<sup>15</sup>

All petroleum operations require specific plans to be accepted by National Offshore Petroleum Safety and Environmental Management Authority before an activity can commence such as a safety case, environment plan, and/or well operations management plan. The Offshore Petroleum and Greenhouse Gas Storage Act 2006 and associated regulations outline the content requirements and acceptance criteria for the relevant permits.

Where appropriate, conditions may be included in an exploration permit title. Failure to comply with conditions of an exploration permit title may result in its cancellation.<sup>16</sup>

Companies have an obligation to report or justify hiring foreign labour or sourcing inputs from abroad and give preferential treatment to

<sup>15</sup> <http://www.petroleum-acreage.gov.au/2016/supporting-information/explore-australia>

<sup>16</sup> <http://www.petroleum-acreage.gov.au/2016/supporting-information/overview-australias-offshore-petroleum-regime>

local targets. Companies are obliged to abide by the requirements negotiated with the government, pending sanctions for non-compliance. Various states have developed voluntary codes of conduct with mining companies, in particular with a view to improve the relationship with local communities. The Australian government may also ask for a Community Development Agreements or Impact and Benefit Agreements. Part of an agreement may be hiring First Nation peoples.

## CERTIFICATION AND STANDARDS

Common Safety Training Program (CSTP)<sup>17</sup>

The CSTP aims to ensure that all new and existing offshore employees have the same core foundation of safety skills. It applies to workers on offshore production and drilling facilities. CSTP requires demonstration and assessment of defined safety behaviours in the workplace.

Everyone working on offshore production and drilling facilities must now have a CSTP card or be working towards obtaining one.

Offshore construction workforces on construction vessels are currently exempt from this requirement. But contractors expecting to work in the Australian oil and gas industry on offshore production or drilling facilities must work towards having their personnel issued with CSTP cards.

<sup>17</sup> <https://www.appea.com.au/safety-environment/safety-competency-programs/>



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## MAJOR COMPANIES

Australian Worldwide Exploration Ltd  
BHP Billiton Petroleum  
Chevron Australia  
ConocoPhillips Australia Pty Ltd  
Eni  
ExxonMobil Australia (Esso)  
INPEX  
Magellan Petroleum Australia  
Metgasco Limited  
OMV Australia Pty Ltd  
Origin Energy  
Quadrant Energy  
ROC Oil Company  
Santos Limited  
Senex Energy Limited  
Shell in Australia  
Total in Australia

For a list of local suppliers:

<https://www.appea.com.au/>

- Has experienced an extended period of strong economic growth
- Strong business and consumer base
- Strong technology sector
- Similar language, culture and business practices
- High personal wealth
- Strong intellectual property (IP) protection

### Market Challenges:

- Australia's remoteness, large land area, and relatively small population have led to market dominance by a few large firms in certain sectors
- Competitors in Australia have some long-established brands with strong reputations and existing supplier relationships
- Australia has ready access to Asian and other low-cost producers. Nova Scotia firms will have to demonstrate sufficient added value to overcome the costs of getting the product to market, and to compete
- Australia covers 3 time zones and the country has provincial regulations as well as federal

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## WORKING IN AUSTRALIA

Australia is attractive for exporters, not for its own market, but the access to Asian countries. Australia has free trade agreements with Thailand, Singapore, China, Malaysia, Korea and Japan. In light of the cancelation of the Trans Pacific Partnership, accessing these markets through an Australian partner may be beneficial.

### Market Strengths:

- Australia has a stable political environment
- Relatively transparent regulatory structure

Until recently, Australia's High Court has ruled that foreign offshore workers, on vessels operating in the lucrative offshore resources industry, are required to have an Australian work visa such as a 457 visa and must receive minimum pay and conditions. On April 18, 2017, the Australian government announced that the Temporary Work (Skilled) visa (subclass 457 visa) will be abolished and replaced with the completely new Temporary Skill Shortage (TSS) visa.<sup>18</sup> Canadian travelers also must have an Electronic Travel Authority (ETA) to visit Australia.

<https://www.eta.immi.gov.au/ETAS3/etas>

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<sup>18</sup> <https://www.border.gov.au/Trav/Visa-1/457->

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

World Energy City Partnership member, Perth, is the Capital City of Western Australia and is consistently ranked by the Economic Intelligence Unit as one of the top 10 most liveable cities in the world.

Approximately 40% of LNG projects in Australia have their machinery, labor and inputs imported. With the bulk of the major LNG projects completed, the industry is transitioning from construction to management and operations.

Best Prospects:

- Operations and maintenance services
- Environmental services
- Specialised hi-tech equipment
- Decommissioning (in the future)
- Research & Innovation including mini/micro LNG facilities, intelligent operations (automation), hydraulic fracturing
- Subsea & Marine such as expanded ROV operator capacity, offshore supply/operation/maintenance of vessels, flexible pipe technology
- Unconventional Gas incl. horizontal drill rig expertise/maintenance, water management
- Operations & Maintenance including specialized inspection/auditing services, on-location support services
- Logistics & Transport including rotary aviation training & facilities

Bear Head LNG Corporation is a wholly owned subsidiary of LNG Australia. The company is developing an 8 mtpa or greater LNG export terminal in Nova Scotia. Nova Scotia companies could leverage relationships with LNG Australia to gain access to the Australian market.

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

The drop in oil prices may have resulted in lack of interest in IOCs in exploring Australia's offshore oil and gas industry. Australia's government plans a tax review in order to boost revenue.

However, the Australian energy market is predominately based on LNG exports. Before oil prices dropped, LNG operators had already sold most of the available capacity from Australia's LNG plants on long-term customer contracts. Contract pricing formulas are typically linked to oil prices. Fortunately, the Australian contracts were locked in at around US\$80 or above before the oil crisis. With expansion strategies in hand, Australia plans to become the world's biggest exporter of LNG by 2019.

## **RENEWABLE INDUSTRY**

Renewable energy generation is a priority at all levels of government and the private sector in Australia. Yet, the percentage of energy derived from renewable sources is still relatively small. Renewable energy production increased by 2% in 2014-15 to reach 343 petajoules. The fall in hydropower and biomass outweighed the growth in wind and solar. Electricity generation from wind power is expected to almost triple the current rate to account for over 10% of Australia's total electricity generation by 2034-35.

### **Tidal Power**

There are a few tidal and wave projects in Australia, one is yet to be confirmed as the company is waiting for government commitment.

The Perth Wave Energy Project, located at Garden Island, Western Australia was the first demonstration of a complete grid-connected CETO system anywhere in the world, the only wave project to consist of more than one wave energy unit connected together and the only wave project to produce both power and freshwater.<sup>19</sup>

A tidal energy turbine was installed in the Tamar estuary in Launceston, Tasmania. Researchers at the Australian Maritime College, a specialist institute of the University of Tasmania, are conducting field experiments with a 2.4 metre-wide prototype in partnership with Sydney-based developers MAKO Tidal Turbines. Tasmania is seen as a location with huge renewable energy potential, and the site near Reid Rock was selected because of the ideal speed of the current. The turbine is secured beneath a floating platform and connected to a mooring on the east side of the estuary.<sup>20</sup>

Other companies involved in tidal energy include BPS Energy and Carnegie Clean Energy Limited. Carnegie has currently under development proposal to create a Wave Project and Centre of Excellence in Albany, Western Australia. The Project will be the first commercial scale wave farm in Australia and will demonstrate the potential for WA and Australia to tap into a highly consistent renewable resource; delivering 24/7 clean power into the electrical grid. The Project, to be delivered in stages, will involve an initial 1MW unit followed by a 20MW wave farm resulting in over A100m of local investment.

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<sup>19</sup> <http://carnegiwave.com/galleries/perth-wave-energy-project/>

<sup>20</sup> <http://www.amc.edu.au/about-amc/news-and-events/news-items/tidal-energy-potential-tested-in-tasmanias-tamar>

Successful demonstration of the 20MW farm could in turn lead to a 100MW expansion.

Outside of Australia, the country based CSG Exploration & Production Services plans to build a 50kW pilot wave energy power plant in Zonguldak Province in the Black Sea region of Turkey.<sup>21</sup>

## Hydropower

Hydropower is the largest contributor to renewable generation in Australia, with a share of 39% in 2014–15. Nonetheless, hydropower is down from 86% of renewable generation in 2004. Hydro's share of total electricity generation in 2014–15 was the lowest since the drought of the mid-2000s. Water supply is an issue for Australia to realize its hydropower potential.

The Australia government announced in March 2017 an AUD\$2 billion plan to expand the iconic Snowy Hydro scheme. The government will carry out a feasibility study into the idea of adding "pumped hydro" storage capacity, which it could power up to 500,000 homes.<sup>22</sup>

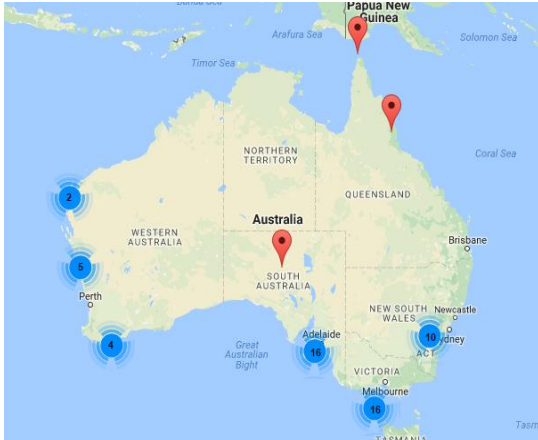
## Wind Power

Wind was a close 2<sup>nd</sup> behind hydro in its contribution to renewable generation in 2014–15, contributing 33% of renewable electricity and 5% of total electricity generation. Wind generation rose by 12% in 2014–15. Wind generation continues to be particularly prevalent in South Australia, accounting for one-third of its total energy mix.

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<sup>21</sup> <http://tidalenergytoday.com/2017/04/11/australian-csg-to-construct-wave-power-plant-in-turkey/>

<sup>22</sup> <https://www.theguardian.com/australia-news/2017/mar/17/seawater-could-provide-the-solution-to-south-australias-power-woes>



**Figure 5 Wind Farm Map Source: The Wind Power**

There are 62 wind farms in Australia. Wind energy market actors are:

- AGL
- Caspian Technology Company
- Duet Group
- Infigen Energy
- Origin Energy
- Pacific Hydro
- Roaring 40s
- Stanwell Corp
- Verve Energy

### Solar Power

Solar generation also continued to grow strongly in 2014–15, by 23%, and accounted for 2% of total electricity generation. The largest growth occurred in New South Wales, including the Royalla Solar Farm. Solar growth in the country is attributed to small base, and rooftop solar PV installations.

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Best Prospects:

- Water management consulting for hydropower

- ICT-based solutions to manage and maintain infrastructure assets
- Smart grid management for managing uninterrupted power supply in remote locations for wind power
- Cost effective energy storage solutions
- In April 2017, South Australian government’s received 90 responses for an RFP for ground breaking battery storage tender. This was the first fact-finding round. Nova Scotia companies could work with Australia-based developers in tandem with international battery storage manufacturers.

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

Australia’s target for renewable energy is 23.5% by 2020.<sup>23</sup> The Prime Minister established a Task Group on Energy Efficiency; and a National Strategy on Energy Efficiency. From this initiative the Energy Efficiency Opportunities Program was created to establish the Australian Energy Market Commission, the Australian Energy Regulator and the Australian Energy Market Operator. These divisions are responsible for regular reviews of the country’s energy security and reform of the minerals taxation regime.<sup>24</sup>

Since 2010, Australia had a surplus in generation capacity which dampened wholesale prices. This surplus influenced government to decide in 2014 to remove its carbon tax. However, the more popular theory is that the tax was unpopular as it drove up people’s energy bills.

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<sup>23</sup> <http://www.environment.gov.au/climate-change/renewable-energy-target-scheme>

<sup>24</sup> Energy Policies of IEA Countries, Australia 2012

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## FUNDING INCENTIVES

EDC has funding with the following firms to purchase supply and services from Canadian companies:

- Origin Energy Ltd
- Santos Finance Ltd
- Woodside Petroleum Ltd

The Australian Renewable Energy Agency (ARENA) has approximately AUD\$2 billion in funding, which extends until 2022. ARENA funds activities that are expected to advance renewable energy technologies towards commercial readiness, improve business models or reduce overall industry costs. Nova Scotia companies would need to partner with an Australian firm as the lead.

<https://arena.gov.au/funding/>

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<https://www.export.gov/article?id=Australia-Oil-and-Gas>

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[www.appea.com.au](http://www.appea.com.au)

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<http://www.powers.net.au/2015/03/20/the-impact-of-lower-oil-prices-on-australian-equities/>

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[www.rigzone.com](http://www.rigzone.com)

European Centre for Development Policy Management, Local content policies in mineral-rich countries, No. 193 May 2016

## NOTES:

# BRAZIL



## BRAZIL COUNTRY PROFILE

### OVERVIEW

Brazil is the world's seventh biggest economy, the ninth largest oil producer and the second largest oil producer in South America. The main sources of offshore development are deepwater and presalt wells. Presalt production now makes up about a quarter of overall production.

Even though the country is one of the world's largest oil producers, Brazil's energy sector is one of the least carbon-intensive with almost 45% of Brazil's primary energy demand met by renewable energy.

Brazil has been facing a corruption scandal with its oil and gas industry. This scandal has contributed to the decline in production targets and the country's economic downturn. In 2017, the country is expected to improve due to new government policies on foreign investment.

### Country Facts

Nominal GDP	1772.30 Billion USD
Population	204.45 Million
Total Trade/GDP	27.37%
Currency	Brazilian Real (BRL)
Merchandise Imports from Canada	2250.19 Million CAD
Canadian direct investment	12,620 Million CAD
Main imports	Intermediate, Capital and Consumer Goods, Fuels

Figure 6 Source: EDC

### COUNTRY SOURCES OF ENERGY

Sources of energy for Brazil are gas, oil, hydro, renewable, nuclear and coal. Brazil's energy mix continues to evolve as biofuels take market share from oil. However, oil remains the most dominant fuel (35%) followed by hydro (28%). From 2014 – 2035, natural gas consumption is expected to grow by 1.7% p.a. and renewables consumption (including biofuels) is expected to grow by 4.6% p.a.

Much of Brazil's energy comes from renewable sources compared to an average of less than 15% for the rest of the world.<sup>25</sup>

<sup>25</sup> <http://sugarcane.org/the-brazilian-experience/brazils-diverse-energy-matrix>

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

Brazil is focusing on energy supply diversification. Reliance on other sources for power generation from oil is growing, notably in natural gas, wind and bioenergy. Because the country has been in turmoil with high inflation, a depreciating currency and economic contraction, the government plans to auction contracts to bring in investment.<sup>26</sup>

The Brazilian government set a goal to obtain 23% of its energy from renewable sources by 2030. They also plan to reduce carbon emissions by 37% by 2025.<sup>27</sup>

The challenge for the country is new transmission lines, which are needed to connect clean power projects to the grid. About 220 power-line projects were behind schedule as of 2015, about 60% of the total capacity under development. Difficulties getting environmental licenses have caused the most delays.<sup>28</sup>

As well, large hydropower plants account for around 80% of domestic electricity generation. Continued expansion of hydropower is increasingly constrained by the remoteness and environmental sensitivity of the country. Twenty GW of hydropower capacity is under construction in the Amazon region.

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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In 2015, Brazil on average produced 2.3 million barrels per day (m/bpd) of crude oil and

condensates. Brazilian petroleum production is overwhelmingly offshore, with 93% of active wells found in offshore basins.

Petróleo Brasileiro S.A. (Petrobras) is the state-run energy company which basically controls the country's energy industry. They are involved in the exploration of oil and gas; production, refining and supply of crude and oil products; and generation of electric power using renewable energy sources. They operate 21 thermo power plants with an installed capacity of 6,136 MW. The company produces petrochemicals, biofuels, gasoline, ethanol, lubricants, oils, asphalt, fertilizers, LPG, LNG and VNG. Petrobras does not only operate in Brazil, they are engaged in energy activities in 17 countries, making them the world's 4<sup>th</sup> largest energy company. The company is currently withdrawing operations from the Argentine market.

Petrobras also has 15 refineries, 134 production platforms (77 fixed and 57 floating), 100 exploratory rigs (48 offshore), nearly 15,000 productive wells, some 34,600km of pipelines, five biofuels units, three fertilizer plants and an oil tanker fleet of 326 vessels (57 wholly owned).

Over the last 15 years, there has been 1,034 oil blocks awarded through 12 annual oil-concession licensing rounds, plus the first pre-salt round. Petrobras has won the majority of these concessions.

Petrobras is experiencing financial woes; they have ongoing corruption investigations and have decreased their 5-year investment plan by 40 percent. Yet, Petrobras will remain one of the largest investors in the world and was expected to invest US\$19 to US\$20 billion in 2016.

After Petrobras, independent oil companies operating in Brazil including Statoil (3% market

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<sup>26</sup> <https://www.iea.org/countries/non-membercountries/brazil/>

<sup>27</sup> <https://www.theguardian.com/environment/2015/sep/28/brazil-pledges-to-cut-carbon-emissions-37-by-2025>

<sup>28</sup> <https://www.bloomberg.com/news/articles/2016-03-03/brazil-s-clean-energy-boom-running-out-of-steam>

share), Shell (2%), Chevron (1%), and others (with less than 1% of total production) were the other main oil producers and operators in Brazil in 2015.

In October 2015, the Brazilian government held its 13<sup>th</sup> licensing round for 266 blocks, most of which were onshore but also included offshore blocks and three blocks in the 'pre-salt' Campos Basin. The round did not meet expectations as only 37 of the blocks were awarded, most of which were in already developed formations, and included no deepwater blocks. Further, no major IOCs submitted bids, a sign that the price of oil was too low to justify the financial terms offered.<sup>29</sup>

On February 24, 2016, the Brazil Senate approved Bill of Law No. 131/2015 stating that the National Council of Energy Policy should grant Petrobras the pre-emptive right to act as operator in the pre-salt fields. Petrobras would have the possibility to exercise or not such right for each offered block within 30 days. If Petrobras does not exercise this right, any other Brazilian or international oil company would be able to act as operator in the pre-salt layer. The Bill is now pending approval in the lower house of Congress and there is a strong chance it will be approved. This preliminary approval of the Bill is welcomed by the Brazil oil and gas community to help attract investment to Brazil.

Brazil is expected to have the highest number of planned offshore crude and natural gas projects in production in the world in 2017. Brazil plans 38, there will 279 globally, according to a report by Global Data. In terms of operatorship,

Petrobras will lead the world with the highest operatorship of 30 planned projects.<sup>30</sup>

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## PROJECTS

- Royal Dutch Shell plans to invest US\$10bn in deepwater production in Brazil over the next five years on top of the US\$30bn it has already deployed there, making it the largest foreign private sector investor in the nation by far, and second only to the Brazilian state-owned oil company Petrobras.
- Japan's MODEC, Inc. announced that Royal Dutch Shell plc's subsidiary Shell Brasil Petroleo Ltda. has extended a contract with the firm for operations and maintenance of the FPSO Fluminense now working in the Bijupira & Salema oil fields in the Campos Basin off the coast of Brazil. The contract for the floating production storage and offloading (FPSO) facility, which has been in operation at the fields since August 2003, will be extended from August 2016 to December 2020.
- In 2016, Aker Solutions signed an Nkr1bn (US\$120m) agreement to provide maintenance and other services for subsea facilities at offshore oil and gas fields operated by Petrobras in Brazil. The three-year contract, which can also be extended by another three years, will cover maintenance, storage, supply of parts, as well as technical assistance for all subsea equipment delivered by Aker Solutions to Petrobras.
- PACC Offshore Services secured a one-year contract to support the oil and gas production activities of an undisclosed client in the Campos Basin, Brazil, using its semisubmersible accommodation vessel, POSH Xanadu (SSAV).

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<sup>29</sup> <http://www.offshoreenergytoday.com/brazils-13th-bidding-round-fails-to-attract-oil-majors/>

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<sup>30</sup> <http://www.offshore-technology.com/researchreports/researchreportreport-brazil-to-have-the-highest-offshore-crude-and-natural-gas-projects-in-production-in-q1-2017-5765554/>



- Wood Group won a contract to deliver services to Brazil-based PetroRio's Polvo A platform in the southern Campos basin, 100km off the coast of Rio de Janeiro. Under the contract, Wood Group PSN will provide integrated operations and maintenance services.
- Karoon Petroleo & Gas, a Brazilian subsidiary of Karoon Gas Australia Ltd., Melbourne, has let a multiyear contract to Wood Group for the engineering services for full field development of Echidna oil field in the Santos basin offshore Brazil. The contract will be executed from Wood's office in Rio de Janeiro.

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## **GOVERNMENT REGULATIONS AND POLICIES**

Currently, exploration phase activities require between 37% and 85% local goods and services, and development phase activities must use between 55% and 80% Brazilian content.

In order to attract investments, the Brazilian authorities have been discussing necessary changes in the regulatory framework and restrictive policies.

In January 2016, Brazil introduced a new program to offer concessionaires credits that can be applied toward satisfying local content rules (LCRs) in exchange for stimulating the Brazilian O&G supply. This change may make it easier for O&G companies operating in Brazil to meet high LCRs. Brazilian O&G supply chain would also have greater access to lower-cost equipment and services.

The new LCR rules are expected to come into place September 2017. The change in content rules is a 50% reduction in local hiring requirements from the current standard.

Offshore field exploration will require only 18% of staff be Brazilians.<sup>31</sup>

- Additionally, yet to be worked out, Local Content Units ("UCLs") are proposed to be created, which would be granted to a company or consortium that promotes one or more of the following:
  - Entering into of contracts for the purchase of goods, services or systems which enable the creation of new suppliers in Brazil;
  - Direct investment in the expansion of production capacity of Brazilian suppliers;
  - Direct investment in the process of technology innovation of Brazilian suppliers;
  - Purchase of goods and systems in Brazil, with local content, for use outside Brazil; or
  - Acquisition of goods or systems of a pioneering nature, developed in Brazil.

These UCLs can then be applied against local content targets for a particular block to make up for any shortfall on that particular project. This should enable more flexible contracting, making it easier for oil companies to select the most suitable contractors for projects, with foreign contractors not necessarily being excluded for lack of local content.<sup>32</sup>

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<sup>31</sup> <http://oilpro.com/post/30186/brazil-local-content-rules-cut-50>

<sup>32</sup> <http://www.cms-lawnow.com/ealerts/2016/02/reforms-to-brazilian-local-content-policy>



**Figure 7 Offshore Map** Source: World Economist

## CERTIFICATION AND STANDARDS

Since June 2016, the ANP has started publishing the questions and answers sent by Local Content Certificates duly accredited by the ANP with the use of the Local Content Certification Consultation.

<http://www.anp.gov.br/wwwanp/exploracao-e-producao-de-oleo-e-gas/conteudo-local/certificacao-de-conteudo-local/perguntas-e-respostas-sobre-certificacao>

The Brazilian Maritime Authority, states that the Basic Safety Training (BST) is compulsory for all persons which work on-board oilrigs and vessels and are required to stay at least 72 hours on-board. The Helicopter Underwater Escape Training (HUET) is not compulsory in Brazil; however it is highly recommended that all professionals who use helicopters as means of transportation obtain this certification.<sup>33</sup>

Support for Foreign Companies:

<sup>33</sup> <http://www.sheltermar.com.br/en/courses/bosiet/>

APEX Brazil - Brazilian Trade and Investment Promotion Agency

<http://www2.apexbrasil.com.br/en/invest-in-brazil/apex-brasil-services-to-help-you>

ONIP - National Organization of the Petroleum Industry <http://www.onip.org.br/areas-of-activity/?lang=en-to-help-you>

Ministry of External Relations

<http://www.brasilglobalnet.gov.br/arquivos/publicacoes/manuais/pubguilegali.pdf>

## WORKING IN BRAZIL

Market entrance strategies for Nova Scotia companies should be finding an agent or distributor in Brazil, and/or selling to or partnering with another company already doing business in Brazil. It is also recommended for Nova Scotia exporters to hire a Brazilian lawyer and accountant.

Market Strengths:

- Strong and globally integrated business base
- Solid and modern banking system, with presence of world's largest investment banks
- Expanding labour force

Market Challenges:

- Complex regulatory system
- Local content laws in certain sectors
- Long journeys between cities and states, where cultures can vary significantly
- A lot of importance is put on personal contact so you may need to visit several times before securing a deal and therefore high travel costs
- Ranked 76 in the Transparency International's corruption perception index (CPI)

- Ranked poorly in World Bank's ease of doing business index
- Organised crime is a significant problem in some parts of Brazil

Nova Scotians need a visa to travel to Brazil and individual and companies need to plan accordingly as it can take up a month to get a visa from the Brazil Canadian Consulate.

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Rio de Janeiro is the World Energy City Partnership member. The city is headquarters of major companies in Brazil and the capital of major industries with a radius of 500 kms.

Petrobras has restructured its procurement department to centralize all its purchases and contracts under an Executive Management Division called "Suprimentos de Bens e Serviços-SBS" (Goods and Services Supply).

Currently, the registration process for foreign suppliers interested in providing service contracts to Petrobras is limited to the group of service categories listed in the following link: [https://www.petronect.com.br/sap/bc/webdynpro/sap/ypcad\\_lista\\_fam\\_serv?sap-language=E](https://www.petronect.com.br/sap/bc/webdynpro/sap/ypcad_lista_fam_serv?sap-language=E).

Best Prospects:

- Flow measurement equipment
- Mobile well test plants
- Pig valves
- Pig launchers
- Chokes
- Electrical panels
- Completion tools
- Well abandonment expertise
- Offshore equipment and services
- Personnel and crewing service (after the LCR rules drop)

- Subsea technologies
- Inspection, repair and maintenance

Like Nova Scotia, Brazil has a strong shipbuilding industry. US\$100 billion is forecast to be invested between 2012 and 2020 in Brazil's commercial marine industry.

Opportunities for Nova Scotia companies:

- Maritime equipment
- Marine construction and maintenance
- Maritime navigation

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

Since January 2016, Petrobras has been restructuring its finances by decreasing investments, selling assets and shutting down wells. The company is also pursuing a more conservative investment strategy.

The low price of oil prompted Petrobras to shut-in some 22 of its more capital intensive wells and announce its intention to sell US\$15.1 billion worth of its assets. Petrobras is expected to announce reductions totaling US\$16 billion per year as part of its investment plan for 2016 to 2020.<sup>34</sup>

Petrobras is also in the process of reviewing its critical goods and services demand for the next five years. Recent press announcements noted Petrobras' plans to sell gas pipelines, gas-fired power plants and some LNG terminals, which could increase planned divestments to about US\$50 billion.

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<sup>34</sup> [http://trade.gov/topmarkets/pdf/Oil\\_and\\_Gas\\_Brazil.pdf](http://trade.gov/topmarkets/pdf/Oil_and_Gas_Brazil.pdf)

## MAJOR COMPANIES

Petrobras

Rolls Royce, Shell, BP, JCB, Rexam and  
Experian

Aside from Petrobras, 46 local and 45 foreign companies hold oil exploration and appraisal areas in Brazil that could also open investment and equipment supply opportunities.

A.R.G., Aloes, Alvopetro, Anadarko Petroleum Corp., Arclima Aurizônia, Barra Holding, Bayar, BG, BHP, Bolognesi Participações, BP P.L.C., Brasoil, BrazAlta, BTG Pactual, CEMIG, Central Resources, CEPESA, Chariot, Cheim, Chevron, CNOOC, Codemig, COPEL,

Cowan, Delp, EBX, Ecopetrol S.A., Egesa, EP Imetame, ERG, Eromanga, Exxon Mobil Corporation, G&C, Galp Energia, GDF Suez, Genesis 2000, Geopark Limited, Government of China, Gran Tierra, Statoil

ASA, Total, Inbrael, Inpex, Karoon, Lábrea, Maersk, Niko, ONGC, Orion Holding Participações, Ouro Preto Óleo e Gás, Pacific Rubiales, Panergy, Panoro, Parnaíba Gás Natural, Partex Oil and Gas, Perenco, Perícia Engenharia, Petro Latina, Petro Rio S.A., Petrorecôncavo S.A., Premier Oil PLC, Proen, PTT E&P, QGEP Participações S.A., Quantra, Ral, Repsol YPF, Rio Proerg, Rosneft, Royal Dutch Shell PLC, Serena, Severo & Vilares, Sinochem, SINOPEC, Sollita, Sonangol, Stogas, STR,

The National Organization of the Petroleum Industry (ONIP) works with Brazilian companies and government:

[www.onip.org.br](http://www.onip.org.br)

## RENEWABLE INDUSTRY

Brazil is Latin America's largest renewable energy market. The economic crisis also affected this sector as the country has had flat economic growth. However, the country is committed to investment across renewable energy as the country generates 76% of electricity from these resources.

### Wind Power

Wind capacity in Brazil is the largest in Latin America with nearly 9 GW of installed capacity. The country has 370 wind farms. Brazil's energy regulator has approved the construction of over 9 GW of additional wind power, with 3 GW under construction in 2016 and an additional 6.1 GW whose construction has not commenced.

According to the Brazilian government's Energy Research Agency (EPE), the wind industry would need to install 17 GW of new wind capacity over the next decade to meet the country's target of 24 GW of installed wind generation capacity by 2024.

A U.K. power utility is investigating with two local partners in Brazil to acquire minority stakes in about 640 MW of operating wind farms from state-run utility Eletrobras. The utility is seeking to sell assets to ease its debt load of about 46 billion reais (\$14.7 billion). The utility owns stakes in 110 special-purpose entities that own power plants which are scheduled to be sold in 2017.<sup>35</sup>

Wind service providers should find the most opportunities since component suppliers face strong competition from local manufacturers that benefit from advantageous financing terms.

Manufacturers in Brazil are WEG and Wobben.

<sup>35</sup> <http://www.renewableenergyworld.com>

Developers include:

- Abengoa
- Aeolus
- Alupar
- Asa Branca
- Brennard
- Casa dos Ventos
- Chesf
- Copel
- CPFL
- Cubico Sustainable Investments

Complete listing:

[http://www.thewindpower.net/country\\_windfarms\\_en\\_26\\_brazil.php](http://www.thewindpower.net/country_windfarms_en_26_brazil.php)

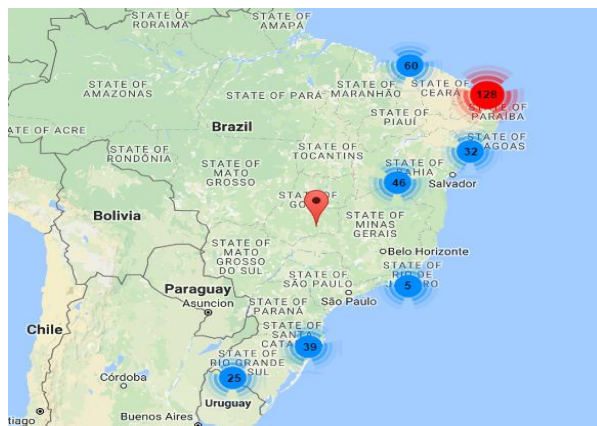


Figure 8 Wind Farm Map Source: The Wind Power

## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

### Hydropower

The lack of production from some of Brazil's largest hydropower dams due to droughts has resulted in the country deciding to lessen its dependence on large hydropower.

Opportunities would be with engineering firms that have expertise in increasing efficiency and generation capacity in existing dams through technological and engineering services.

### Solar Power

Today, solar power accounts for only 0.02% of Brazil's total installed electricity generation. Solar generation contracts have not yet begun construction. BNDES alone (Brazilian Development Bank) expects to invest US\$2.5 billion in solar development through 2018.

Local content requirement rules mandate that solar modules be assembled in Brazil, but cells and other equipment can be imported. (These rules could change.)

Best Prospects:

- Resource mapping
- Turbine design
- Environmental impact assessment

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

Energy policy makers have ambitiously set clean energy capacity targets of 24 GW wind and 7 GW solar by 2024. According to Brazil's National Electric Energy Agency (ANEEL), installed wind capacity is currently at 8.7 GW, with a further 9 GW already under construction and tendered. The installed capacity for solar is at just 27 MW; with a further 2.2 GW tendered. Upon installation, the tendered power will represent a 750% increase in installed solar power capacity.

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## FUNDING INCENTIVES

Export Development Canada has financing in place at Brazil firms for the purchase of good and supplies from Canadian companies:

- CPFL Energia S.A.
- Petrobras Netherlands BV

- Vale S.A.

Nova Scotia companies should contact their local EDC representative for assistance.

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## **OTHER SOURCES OF INFORMATION**

2016 ITA Upstream Oil and Gas Equipment Top Markets

Report [http://trade.gov/topmarkets/pdf/Oil\\_and\\_Gas\\_Top\\_Markets\\_Report.pdf](http://trade.gov/topmarkets/pdf/Oil_and_Gas_Top_Markets_Report.pdf)

Petrobras 2017-2021 investment plan, procurement department restructuring, and suppliers/service registration information  
<https://www.export.gov/article?id=Petrobras-2017-2021-Investment-Plan-Procurement-Department-Restructuring-and-Suppliers-Service-Registration-Information>

A snapshot of Brazil's renewable energy opportunities, Paul Dvorak, 2016  
<http://www.windpowerengineering.com/feature-d/business-news-projects/snapshot-brazils-renewable-energy-opportunities/>

Running Out of Steam, Vanessa Dezem, March 2, 2016  
<https://www.bloomberg.com/news/articles/2016-03-03/brazil-s-clean-energy-boom-running-out-of-steam>

Brazil export overview 2017  
<https://www.gov.uk/government/publications/exporting-to-brazil/exporting-to-brazil>

2016 WORLD ENERGY COUNCIL | ISSUES MONITOR

<https://www.worldenergy.org/publications/2016/world-energy-issues-monitor-2016/>

US Commercial Service Industry  
<http://trade.gov/topmarkets/>

How Does the Changing Price of Oil Affect Economies around the World?

BP Energy Outlook

<http://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2016/bp-energy-outlook-2016-country-insights-brazil.pdf>  
 International Energy Agency

US Commercial Service

<https://www.iea.org/countries/non-membercountries/brazil/>

Reforms to Brazilian Local Content Policy

<http://www.cms-lawnow.com/ealerts/2016/02/reforms-to-brazilian-local-content-policy>

Oil & Gas Journal [www.ogi.com](http://www.ogi.com)

### **NOTES:**

# CANADA



## Country Facts

Nominal GDP	\$2067 billion
Population	36.4 million
Total Trade/GDP	25%
Currency	CAD Dollar
Top Merchandise Imports	\$46,312 millions
Total FDI	\$188 billion
Main Imports	Crude Oil, Automobile and Truck Parts, Medications, Electronics

Figure 9 Source: Statistics Canada April 2017

## CANADA COUNTRY PROFILE

### OVERVIEW

Canada is the 5<sup>th</sup> largest producer of natural gas and the 6<sup>th</sup> largest producer of crude oil in the world, trailing only to China, US, Russia and Saudi Arabia.

Ninety-seven percent of the world's largest oil reserves are located in the Alberta oil sands. Remaining oil reserves are located in Saskatchewan and offshore Newfoundland & Labrador. Natural gas fields are located in British Columbia, Alberta and offshore Nova Scotia. Northern Canada is also seeing increasing exploration and development. The oil and natural gas industry is Canada's largest private sector investor, with oil sands alone

injecting almost CAD\$23 billion into Canada's economy in 2015.<sup>36</sup>

Canada is an energy intensive country compared to other industrialized nations. Much is of this is due to the reliance on automobiles and remoteness of populations from major city centres. As the country is vast, so is the energy industry between its provinces and territories.

For the most part, Canada's economy is fueled by petroleum, natural gas, and hydroelectricity. In 2016, the government made a commitment to invest in clean technology, including new energy related projects.

This country profile focuses on the provinces of Alberta, Nova Scotia and Newfoundland as these are the host provinces to the World Energy Cities of Calgary, Halifax and St. John's.

<sup>36</sup> <http://www.canadasoilsands.ca/en/explore-topics/economic-contribution>

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## COUNTRY SOURCES OF ENERGY

Hydroelectricity remains the primary source of electric power in Canada accounting for 55% of total capacity. Natural gas, coal, and nuclear plants provide most of the remaining supply, while non-hydro renewables such as wind, solar, and biomass make up 9% of the capacity.<sup>37</sup> Two-thirds of Canada's fossil fuel generation plants are fueled with coal.

The electricity supply mix varies significantly amongst the provinces and territories. Quebec, British Columbia (BC), Manitoba, Newfoundland & Labrador, and Yukon have significant hydroelectric resources which are used to supply most of their electricity needs. Saskatchewan and Alberta rely on locally abundant coal resources but have been expanding their natural gas-fired resources. Nuclear power plants represent approximately one-third of Ontario's capacity, with natural gas and hydro providing much of the remaining power. Atlantic Canada relies on a combination of hydro, various fossil fuels, nuclear, and non-hydro renewable resources. Diesel-fueled plants account for most of the capacity in Nunavut and NWT.<sup>38</sup>

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## CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

Alberta leads the country's demand for oil and gas, particularly for operating the oil sands. Energy use trends in Atlantic Canada can be unpredictable depending on the demands of the region's industrial activities. Atlantic Canada uses a much higher share of refined products than the rest of Canada due to infrastructure limitations. In the western provinces, natural gas is used relatively more than other regions

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<sup>37</sup> <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2016/fslctrct-eng.html>

<sup>38</sup> National Energy Board of Canada 2016

because it is readily available and it is price competitive.<sup>39</sup>

Canada's oil sands had experienced the worst market in decades causing company shut downs and project delays. This resulted in the oil and gas industry undergoing rapid transformations in both the types of resources extracted and extraction technologies. Continued productivity will play an important role in the exploration and shaping of Canada's fossil fuel industry. Analysts predict that the oil sands industry will grow by 800,000 barrels in 2017.

The outlook for the industry across Canada is improving. Canada's energy producers are returning to growth mode. The renewed focus on expansion is occurring as the Canadian government in 2016 approved construction of two expanded energy pipelines that will add almost a million barrels a day of export capacity to Western Canada.<sup>40</sup>

Politically, the country is trying to balance energy development with its commitment to reduce greenhouse gas emissions by 30% below 2005 levels by the year 2030. Canada's employment and economic prosperity relies heavily on its energy sectors. Canadians want a vibrant industry and they want the industry to use good environmental practices.

In response, the federal government created The Pan-Canadian Framework on Clean Growth and Climate Change.<sup>41</sup> The framework outlines Canada's strategy to reach its climate change

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<sup>39</sup> <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2016pt/prvnc-trrtrl-cmprsn-eng.html>

<sup>40</sup> <http://calgaryherald.com/business/energy/canadas-oilpatch-moves-into-growth-mode-finally>

<sup>41</sup> <https://www.canada.ca/en/services/environment/weather/climatechange/pan-canadian-framework.html>



target and to position Canada as a leader in the clean technology industry.

New and improved technology in the energy sector will be key to Canada's growth. To address the need for alternative energy resources, Canadian provinces are investing in hydropower, wind power and tidal power. Improved technologies in deep water exploration are also helping to elevate Canada's productivity.

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## ENERGY INDUSTRY

### OIL AND GAS

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Canada's oil and gas reserves, including reserves of non-conventional resources (oil sands) and shale gas, makes Canada one of the world's leading exporters. Canada has 171 billion barrels of oil that can be recovered economically.

Companies in the country's oil sector are both domestic and international. Many Canadian firms participate in upstream oil and natural gas ventures, from large-scale active or planned commercial projects, to smaller pilot projects that serve as test beds for new technologies. The largest Canadian energy companies with a presence in the domestic upstream and downstream sectors include Suncor (which acquired Petro-Canada in 2009), Syncrude, Canadian Natural Resources Limited, Imperial Oil, Cenovus (which was spun off from Encana), and Husky Energy. Other Canadian companies, particularly Enbridge and TransCanada, dominate midstream pipeline infrastructure.<sup>42</sup>

### OIL SANDS

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Oil sands development is expected to contribute more than CAD\$4 trillion to the Canadian

economy over the next 20 years — about CAD\$200 billion per year. Direct employment in Canada as a result of new oil sands investments are expected to grow from 151,000 jobs in 2014 to 225,000 jobs in 2038. When including indirect jobs, employment numbers will more than double across Canada.<sup>43</sup>

Within Alberta, there are three major oil sands deposits, the largest of which is the Athabasca deposit, followed by Cold Lake and Peace River. Additionally, the traditional center of Canada's oil production has been the Western Canada Sedimentary Basin (WCSB). This field stretches from British Columbia across Alberta and Saskatchewan to Manitoba and part of the Northwest Territories. The WCSB contains some of the world's most abundant supplies of oil and natural gas, and still remains a significant source of conventional oil production.

### OFFSHORE

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The offshore oil and gas industry is important to Atlantic Canada's economy. Through royalties, taxes and job creation, the highs and lows of the energy industry has a major impact on all four provinces.

The East Coast offshore is still considered a frontier industry, yet many prominent oil companies are pursuing this market. There is an estimated 12 billion barrels of crude oil off Newfoundland & Labrador, as well approximately another eight billion barrels of oil off of Nova Scotia. Only 5% of Newfoundland & Labrador's offshore is under license. The East Coast offshore is categorized as deepwater and harsh climate.

Total expenditures of CAD\$39 billion have been generated from the offshore since 1996. The

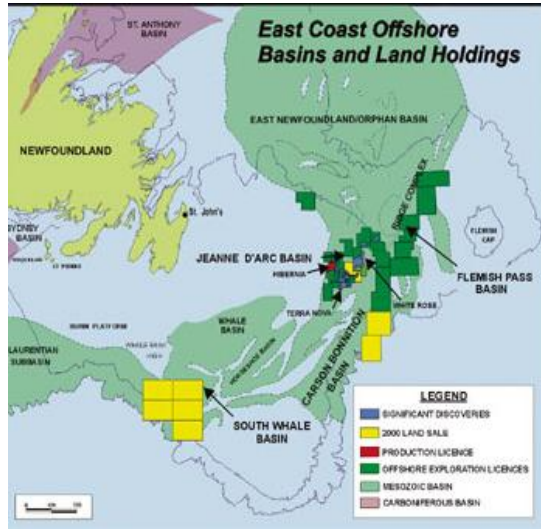
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<sup>42</sup> US Energy Information 2015

<sup>43</sup> <http://www.canadasoilsands.ca/en/explore-topics/economic-contribution>

sector contains more than 800 companies both domestic and international, directly employing more than 9,500 people.

## NEWFOUNDLAND & LABRADOR



**Figure 10 Offshore Map Source: Government of Newfoundland & Labrador**

Most offshore crude oil and other liquids production in Canada takes place in the Jeanne d'Arc Basin, off the eastern shore of Newfoundland & Labrador. Light crude oil production from offshore areas in Eastern Canada averaged about 220,000 b/d in 2014, nearly 14% of Canada's total crude oil production.<sup>44</sup>

### Significant Offshore Fields:

#### Hibernia

Most of Canada's offshore output comes from the ExxonMobil-operated Hibernia field, which came online in 1997 and produced about 115,000 b/d in 2014. Continued drilling is

<sup>44</sup> US Energy Information 2015

happening at the Hibernia Southern Extension (HSE). The Hibernia Management and Development Co. (HMDC) is planning a CAD\$2-billion expansion to enable additional wells to further develop the Ben Nevis-Avalon reservoir.

#### Terra Nova

Terra Nova, operated by Suncor on behalf of a large consortium, accounted for nearly 46,000 b/d of production in 2014. Output from this field increased in 2014 compared with the prior year, although that level is still lower than production achieved in the past decade. Suncor Energy's main activities this year for the Terra Nova oilfield will be ongoing maintenance. In 2015, Terra Nova produced about 37,000 b/d.

#### White Rose

Husky Energy operates White Rose; production from this field has been below its historical levels, about 54,000 b/d in 2014 (combined with the North Amethyst field production). In 2015, White Rose produced about 33,000 b/d.

Production from the North Amethyst-Hibernia zone is scheduled to begin in 2017. Production from the West Rose satellite field is expected to begin in the 2020.

#### Hebron

The Hebron oil field is located in the Jeanne d'Arc Basin and is estimated to contain 700 million barrels of recoverable resources. The project is currently under development. It is owned by a co-venture of ExxonMobil Canada Properties (35.5%), Chevron Canada Limited (29.6%), Suncor Energy Inc. (21%), Statoil Canada Ltd. (9%), Nalcor Energy - Oil and Gas Inc. (4.9%).

The Bull Arm fabrication site in Trinity Bay faces an uncertain future after the Hebron project is towed out to sea. Nalcor says it's not ruling out

any options for the property, including an outright sale. Work on the Hebron project is nearing completion. Nalcor is currently searching for new uses for the site either in oil and gas, manufacturing and/or shipbuilding.<sup>45</sup>

### Flemish Pass

Statoil has confirmed it is planning to drill two exploration wells in the Flemish Pass Basin in 2017. The exploration drilling could bring hundreds of new jobs to Newfoundland & Labrador’s offshore oil sector. The Flemish Pass Basin is estimated to contain between 300 and 600 million barrels in the Bay du Nord.

## NOVA SCOTIA

There are two producing offshore natural gas projects in Nova Scotia: the Sable Offshore Energy Project (operated by ExxonMobil) and Deep Panuke (operated by Encana). There is currently no oil being produced in Nova Scotia.

However, there is significant exploration activity underway. Statoil has acquired two licences offshore Nova Scotia. As well, even though Shell has discontinued their exploration in the Shelburne basin, the company is still encouraged that there will be future opportunities. Over CAD\$2 billion in exploration commitments have been made in recent years, with activity focused on deep water prospects. The Government of Nova Scotia estimates Nova Scotia’s offshore resource potential is 120 trillion cubic feet of natural gas and 8 billion barrels of oil.

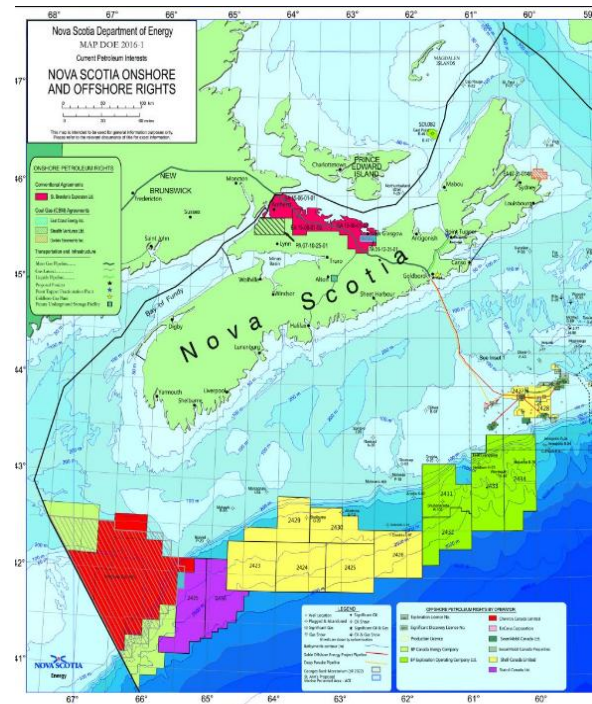
## OTHER ENERGY

### Shale Gas

Significant deposits of unconventional natural gas reside in the WCSB in the form of coalbed

<sup>45</sup> <http://www.cbc.ca/news/canada/newfoundland-labrador/bull-arm-exxon-husky-1.4026061>

methane (CBM), shale gas, and tight gas. Canada has an estimated 573 Tcf of unproved technically



**Figure 11 Nova Scotia Offshore Map Source: Nova Scotia Department of Energy**

recoverable shale gas. By 2030, the National Energy Board projects moderate growth in light oil production from tight oil plays in the WCSB as conventional heavy oil production declines. However, the development of tight oil reservoirs in Canada is still in its early stages.

In 2014, the Nova Scotia provincial government legislated a ban on hydraulic fracturing. New Brunswick currently has moratorium in effect.

### Coal

Canada has about 6.6 billion tonnes of proved recoverable coal reserves, or 96 years of production at the current rate. The great majority of Canadian coal resources are located in Western Canada, but coal has also been produced in New Brunswick and Nova Scotia. After a 15 year hiatus, coal is once again being

mined in Nova Scotia. The Donkin Mine opened in March 2017. The mine is managed by the Kameron Coal Management Ltd., a subsidiary of US mining giant, the Cline Group.

## LNG

Canada has a burgeoning LNG (liquid natural gas) industry on both the East Coast and West Coast of Canada. Twenty-eight companies have applied for 35 LNG export licenses in the country.

The Canaport terminal, operated by Repsol in partnership with Irving Oil, began exporting LNG from New Brunswick in 2009. In Nova Scotia, there are two new plants under development. The Goldboro LNG owned by Pieridae Energy Canada will supply natural gas via the existing Maritimes & Northeast Pipeline, which is located directly adjacent to the project. The Bear Head LNG Corporation is developing a billion dollar 8-12 mtpa LNG export terminal in Point Tupper, Nova Scotia. Nova Scotia is well positioned to become a leading LNG exporter and has many competitive advantages such as deep tide-water access, unrivaled infrastructure, clear environmental processes, access to pipelines in North America and attractive shipping distances to overseas markets.

## Pipeline Infrastructure

Canada's transmission pipelines move approximately 1.2 billion barrels of liquid petroleum products and 5.4 trillion cubic feet of natural gas annually. This energy export contributed CAD\$11.5 billion to Canada's gross domestic product (GDP) in 2015. The industry is responsible for almost 34,000 full-time equivalent jobs across Canada. In 2015, the industry invested CAD\$16.7 million in innovative technology focused on reducing corrosion, improving pipeline inspection and leak

detection. The industry estimates they will invest a total of CAD\$50 billion in Canadian pipeline projects over the next five years.<sup>46</sup>



**Figure 12 Map of Pipelines Source: CAPP**

A number of pipeline projects have recently been approved.

- Line 3 Replacement project: (Enbridge) Approved 2016
- Keystone XL: (TransCanada) Approved March 2017
- Trans Mountain Expansion: (Kinder Morgan) Approved 2016

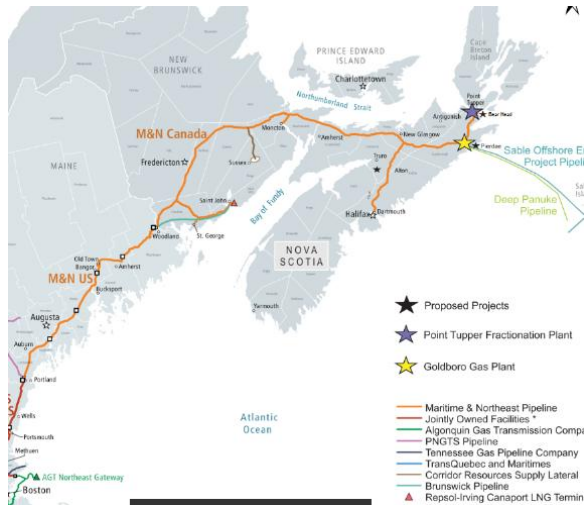
The Northern Gateway: (Enbridge) Was not approved in 2016

**Energy East - Extensions:** (TransCanada) In approval process.

Energy East is a 4,500-kilometre pipeline that will transport approximately 1.1 million barrels of crude oil per day from Alberta and Saskatchewan to the refineries of Eastern Canada and a marine terminal in New Brunswick.<sup>47</sup>

<sup>46</sup> CEPA Canadian Energy Pipeline Association

<sup>47</sup> <http://www.energyeastpipeline.com/>



**Figure 13 Nova Scotia Pipelines Source: Nova Scotia Department of Energy 2017**

## PROJECTS

### WESTERN CANADA

- MEG Energy Corp plans to spend CAD\$590 million in operations this year in Alberta, almost five times more than in 2016, as it expands production at the Christina Lakes oil sands site by about 25 percent.
- Canadian Natural is moving ahead with its 40,000-barrel-a-day Kirby North project.
- Imperial Oil's Kearl Mine started in Q3 2015. Phase 3 of the project is expected by 2020. The cost of the project is CAD\$16 billion. Beyond 2020, the Kearl debottlenecking project is going to increase capacity by 125,000 bbls/d and Cenovus is looking to start Narrows lake Phase A, which will bring 45,000bbls/d.
- Teck Cominco Frontier Oil Sands Mine - Regulatory review process will continue into 2016. The capital cost has been increased to CAD\$20.6 billion and the total capacity is now 260,000 bbls/d.
- Suncor Fort Hills - 2017 fourth quarter is on stream date and 180,000bpd.

Estimated development costs of CAD\$13.5 billion.

- Athabasca Oil Corporation HS-2B Expansion for 2019 adding 32,000 bbls/d.
- ExxonMobil is currently working on the development of the WCC LNG project in British Columbia. A definite starting production date is still to be determined. The project will add 30 million metric tons per year of liquefied natural gas and is estimated to cost more than CAD\$25 billion.

### EASTERN CANADA

- Oil companies have promised to spend CAD\$757,989,794 for the right to explore off the East Coast of Newfoundland & Labrador. Six out of the seven bids in the Eastern Region were accepted, with BP Canada Energy Group and Noble Energy Canada gaining an interest in four areas in the West Orphan and Flemish Pass basins. Hess Canada Oil and Gas will partner on the work in three of the parcels. Other companies promising to do work include Navitas Petroleum, DKL Investments and Nexen Energy. In the Jeanne d'Arc region, about 340 kilometres east-southeast of St. John's, two out of three bids on the three parcels were accepted. Husky Oil Operations Ltd. won both parcels, and will spend CAD\$244,017,776 for the right to determine oil prospects in these parcels.
- Israeli energy conglomerate, Delek Group, won a tender for the right to explore a deep-water block offshore Newfoundland & Labrador, with a small private Israeli operator, Navitas Petroleum. Delek will own 70% of the

venture and Navitas the rest. The partners have committed to invest CAD\$48 million.

- BP Oil plans to drill a well in 2018 in deep waters offshore **Nova Scotia**. The maximum number of BP wells would be six under this plan.
- Sable Offshore Energy Decommissioning project will begin in 2017 in **Nova Scotia**. ExxonMobil Canada (EMC) is the proponent. Opportunities may be found with contractors Blue Water Group, HNZ Group, and Secunda Canada LP.
- Husky Energy announced an expanded West White Rose project. The \$2.2-billion project is to produce first oil in 2022, using a fixed wellhead platform tied to the SeaRose floating production, storage and offloading vessel about 350 kilometres east of St. John's, N.L. Peak production is estimated to reach rates of about 75,000 barrels per day by 2025.

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## GOVERNMENT REGULATIONS AND POLICIES

Policies, programs, and regulations are continually under development at federal, provincial, territorial, and municipal levels.

### WESTERN CANADA - OIL SANDS

Federal review of oil sands development proposals is coordinated by the Canadian Environmental Assessment Agency (CEAA). CEAA works cooperatively with industry and it facilitates the co-ordination of federal regulatory reviews and provincial regulators.

Alberta's facilities are regulated by the provincial government's Environment and Parks department, which sets the policy, and the Alberta Energy Regulator (AER) ensures the policy is applied.

Alberta Environment and Parks sets the thresholds to minimize the impact of oil sands development on air, land and water and the development of environmental frameworks. It is also responsible for regional planning, integrated land management and land use policy.<sup>48</sup>

### EASTERN CANADA- OFFSHORE

The primary legislation governing oil and natural gas activities offshore Newfoundland & Labrador and Nova Scotia is under the Canada–Newfoundland and Labrador Atlantic Accord Implementation Act<sup>49</sup> and the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act.<sup>50</sup> Offshore oil and natural gas operations in Newfoundland & Labrador are regulated by the Canada-Newfoundland & Labrador Offshore Petroleum Board (C-NLOPB), an independent administrative board jointly appointed by the federal and provincial government. Their mandate is to interpret and apply the provisions of the Atlantic Accord and the Atlantic Accord Implementation Acts to all activities of operators in the Newfoundland & Labrador Offshore Area, and to oversee operator compliance with those statutory provisions.

Similarly, in Nova Scotia, the Canada-Nova Scotia Offshore Petroleum Board (C-NSOPB) regulates the industry. Operators are required to submit a variety of plans and meet specific requirements in order to receive authorization from the C-NLOPB or C-NSOPB to conduct work offshore: Safety Plan, Environmental Protection Plan Contingency Plan, and a Benefits Plan. The Benefits plan describes a plan for the employment of Canadians and, in particular, members of the labour force of the

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<sup>48</sup> <http://www.canadasoilsands.ca/en/explore-topics/regulation-and-monitoring>

<sup>49</sup> <http://laws-lois.justice.gc.ca/eng/acts/C-7.5/>

<sup>50</sup> <http://laws-lois.justice.gc.ca/eng/acts/C-7.8/>

province. Canada may also ask for a Community Development Agreement. Part of the agreement may be the hiring of First Nation peoples.

For more information:

<http://atlanticcanadaoffshore.ca/regulation/>

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## **CERTIFICATION AND STANDARDS**

Alberta Oil Sands requires all standard oil and gas certifications.

There are a number of mandatory safety training courses required before working on an offshore installation in Atlantic Canada.<sup>51</sup> This includes:

- Basic Survival Training
- Helicopter Underwater Emergency Breathing Apparatus (HUEBA)
- Helicopter Underwater Escape Training (HUET)
- Hydrogen Sulphide (H<sub>2</sub>S) Awareness
- Workplace Hazardous Materials Information System (WHMIS)
- Regulatory Awareness Training

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## **MAJOR COMPANIES**

Suncor  
Enbridge  
Canadian Natural Resources  
Husky Energy  
TransCanada Corp.  
Cenovus Energy  
Imperial Oil  
Encana  
ExxonMobil  
Crescent Point Energy  
Pembina Pipeline  
Repsol (formerly Talisman Energy)  
Canadian Oil Sands Limited  
Pacific Rubiales Energy  
Irving Oil  
Nexen  
Syncrude  
BP Canada  
Statoil Canada  
Shell Canada  
Athabasca Oil Corporation  
Tourmaline Oil Corp  
Hibernia Management and Development Co  
Nalcor Energy Oil and Gas  
Aker Solutions Canada Inc.  
Atlantic Towing Limited  
Crosbie Salamis Limited  
Halliburton Group Canada  
Schlumberger Canada Ltd.  
Wood Group Canada Inc.

For a full listing of local companies, please contact the following industry associations:

<http://www.maritimesenergy.com/>

<http://www.noia.ca/>

<http://www.capp.ca>

<http://www.cossd.com/>

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<sup>51</sup> <http://atlanticcanadaoffshore.ca/training/>

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## **WORKING IN CANADA**

To do business in Canada, exporters have many factors to consider. The country has six time zones, 10 provinces, and three territories, each which is own provincial government. As the 2<sup>nd</sup> largest country in the world, the population is spread out with 90% of people living within 200kms of the US border.

The country has two official languages, English and French. Unless doing business in Quebec or New Brunswick, English will be spoken for businesses in the energy industry.

### Market Strengths:

- Strong economic growth and banking sector
- High personal wealth
- Large and diverse natural resource sectors
- Strong business and consumer base
- Low corruption
- Proximity to the US
- Incentives for foreign companies to open branch offices

### Market Challenges:

- Each province has its own government system, rule and regulations and taxes for working in the energy industry, provincially and municipally, plus there is another set of rules and regulations federally
- High income and sales taxes. These too vary by province
- Remoteness for travel
- The development of tight oil reservoirs is still in early stages in Canada. The extent to which these resources can be produced from is largely undetermined
- Future exchange rates present an uncertainty for Canadian oil producers. Oil exporters are paid in US dollars, while most expenses are incurred in

Canadian dollars. A volatile exchange rate would add further uncertainty in predicting economic returns for Canadian producers

As of March 2016, all visitors to Canada are required to obtain an Electronic Travel Authorization (eTA) before travelling to Canada.

<http://www.cic.gc.ca/english/visit/eta.asp>

Work permits for foreign employees are required. The types depend on the country of origin. Please seek advice from your nearest Canadian Consulate or Embassy.

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## **OPPORTUNITIES IN CANADA**

Canada's energy industry is exploring ways to improve well economics by reducing the cost of explorations and increasing well productivity. This will largely be achieved through technology and process development.

Top opportunities related to the energy sector in Canada will be predominantly based on dealing with large industry players working on long term projects, both in the oil sands and offshore.

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## **FOREIGN DIRECT INVESTMENT**

By 2025, oil production is expected to rise to 4.7 million barrels. To support this growth, investment estimated at CAD\$2 trillion is required. By having 55% of the world's oil reserves available for private sector investment, Canada allows for many opportunities for foreign companies.

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## **NOVA SCOTIA**

The Nova Scotia Department of Energy (NSDOE) is the leading provincial government department for the energy industry. Nova Scotia's offshore is rich with potential. Several world leaders in oil and gas are investing in Nova Scotia's offshore, including Shell Canada, BP, ConocoPhillips



Canada, Suncor Energy, Woodside Petroleum and the Hess Corporation. In renewable energy, Nova Scotia is moving away from coal-based electricity and towards the use of fuels that are cleaner and lower in carbon such as natural gas and other renewables. The province has an abundance of natural renewable resources including wind, marine-renewable, hydropower, geothermal, solar, biomass and energy storage.<sup>52</sup>

World Energy City, Halifax, is the capital city of the province of Nova Scotia with a population of 417,847.

### Key Advantages

- Primary economic engine for Atlantic Canada - 20% of the region's GDP
- Strategically located between major North American, European and Asian markets
- Ranks 8th in International Business Cost Competitiveness (KPMG, Competitive Alternatives 2016) Major North American transportation and logistics hub
- Major projects totaling CAD\$31 billion in Halifax; with CAD\$125 billion throughout Atlantic Canada
- Diverse economy powered by growing industry sectors such as financial services, transportation and logistics and ocean technology
- One of the most highly-educated workforces in North America - close to 70% of the working age population have post-secondary certification
- Ranked Top 10 for Business Friendliness in FDI Magazine's ranking of American Cities of the Future 2015/2016
- Halifax is a world leader in oceans research and technology, a growing sector generating CAD\$4.5 billion in GDP in Nova Scotia and employing

14% of the province's workforce. Nova Scotia has the highest concentration of oceans-related PhDs in the world.

- Nova Scotia's commercial aerospace and defence sector, with locations throughout the Province, employs 3,000 people and generates more than CAD\$850 million in revenues each year. Add the Department of National Defence (DND) to the mix, with an additional workforce of 14,439 and annual expenditures of CAD \$1.7 billion, and you will see why Nova Scotia can compete with jurisdictions worldwide.<sup>53</sup>

### Best Prospects - Oil Sands:

Calgary, Alberta is the World Energy City Partnership member in Western Canada representing many corporate offices of operators in the oil sands.

- Maintenance, Repair and Operations (MRO) for current projects and future start-ups
- Equipment; specialty mining and extraction equipment/services; drilling services, refinery equipment, pipeline construction equipment
- Environmental protection services, water resources, land reclamation, and reducing associated greenhouse gas emissions
- Environmental remediation technology and services, tailings treatment, barrier walls, off-stream water storage
- Safety/security equipment and services
- Pipeline construction equipment and services
- New technologies for solvent injection/co-injection (in situ), waterless extraction (mining), radiofrequency heating/electrical heating (in situ), and "field" upgrading techniques

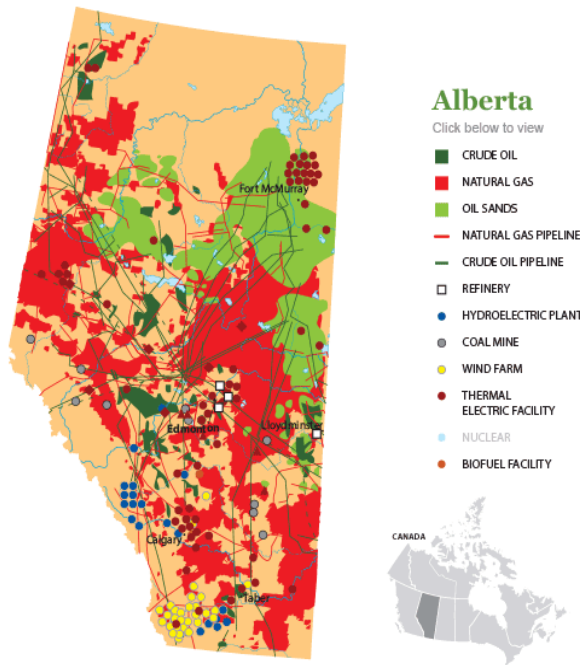
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<sup>52</sup> <https://energy.novascotia.ca/>

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<sup>53</sup> Invest Canada & Halifax Partnership

- Innovative methods for cutting down operating costs and increasing the value of existing assets



**Figure 14 Albert Resource Map** Source: Government of Alberta

### Best Prospects – Offshore:

- Installation products and services including integration and commissioning of all the topsides modules, the installation of the drilling support module and the derrick equipment set
- 2D, 3D and 4D seismic survey services
- Environmental seabed survey services
- FPSO maintenance and upgrade services
- Water-injector technology
- Decommissioning services of natural gas wells
- Equipment: flexible jumpers, flying leads, connectors and Christmas tree flow lines, light well interventions

## LNG

LNG Development will generate an estimated CAD one trillion over the next 30 years.<sup>54</sup> The government committed resources to get plants online by 2020. Companies with expertise in construction and development of LNG plants have good opportunities to work in Canada.

## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

The drop in oil prices had an adverse impact on the Canadian economy, mostly in the province of Alberta. Some projects were put on hold or shelved, employment suffered (110,000 job losses) and several companies restructured. Additionally, the reduction in output caused a slowdown in capital expenditures by 62%, plus drops in cash flow, loss in equity market capitalization, more debt earnings, and a drop in production royalties earned by the provincial governments.<sup>55</sup>

## RENEWABLE INDUSTRY

Canada is one of the world's leaders in the production and use of energy from hydro, wind, solar and biomass. Canada is the world's 3<sup>rd</sup> largest producer of hydroelectricity. The country is also making significant developments in geothermal and marine energy.

Between 2010 and 2014, non-hydro renewables were the fastest growing generation source in percentage terms, with an annual growth rate of 20 percent. In 2014, Canada had close to 13 GW

<sup>54</sup> Natural Resources Canada

<sup>55</sup> CAPP <http://www.capp.ca/media/news-releases/capital-investment-in-canada-oil-and-gas-industry-down-62-per-cent-in-2-years>

of wind, solar, and biomass installations, accounting for 9% of total capacity.

### **Tidal Energy**

Nova Scotia has been harnessing the power of the tides since 1984 and is home to one of three tidal generating plants in the world. Moreover, the highest tides in the world are located in the Bay of Fundy off the coast of Nova Scotia. The tides present opportunities to capture the kinetic energy that is both renewable and predictable.

In 2009, the world's first in-stream demonstration turbine was deployed in the Bay of Fundy. The potential to use the tides through the development of this new technology led to the creation of the Fundy Ocean Research Center for Energy (FORCE).<sup>56</sup> FORCE is Canada's leading test centre for in-stream tidal energy technology and acts as a host to technology developers, providing the electrical infrastructure to deliver power to the grid. FORCE also oversees independently reviewed environmental monitoring at the test site. At present, there are five developers that sublease berths at FORCE and they have received approval to test new technologies. One developer, Cape Sharp Tidal Venture, recently deployed a 2MW in-stream tidal turbine at FORCE which has been connected to the Nova Scotia electrical grid. This turbine is the first of its kind in North America.

There are future plans to deploy more turbines in the Bay of Fundy. Nova Scotia could see in-stream tidal energy devices producing up to 25 MW of electricity in the Bay of Fundy by 2019 and has a post-2020 goal of achieving 300 MW of electricity produced. In addition to FORCE, associations Marine Renewables Canada<sup>57</sup> and

the Ocean Energy Research Association (OERA)<sup>58</sup> are engaged in strengthening Nova Scotia's oceans industry.

Nova Scotia also has up to 2.95 megawatts of approved small scale tidal energy projects in the Digby area. These projects all have local investment from the community through the Community Economic Development Investment Fund. This is a unique option where there is a pool of capital which is raised from individuals within Nova Scotia to invest in for-profit entities within a defined community and in turn the investors receive a substantial tax-credit. These projects will be connected to the distribution grid, powering the local communities. The Province of Nova Scotia supports the development of a tidal energy industry and has given Feed-in Tariffs to encourage large and small tidal projects, like those in the Digby area.

### **Wind Power**

Canada had 6,066 wind turbines totaling more than 11,200 MW of installed capacity operating at the end of 2015, the 7<sup>th</sup> largest wind generating fleet in the world. The costs associated to producing wind energy plummeted by 60% over the last six years. The decrease in expenditures will benefit the growth of the industry.

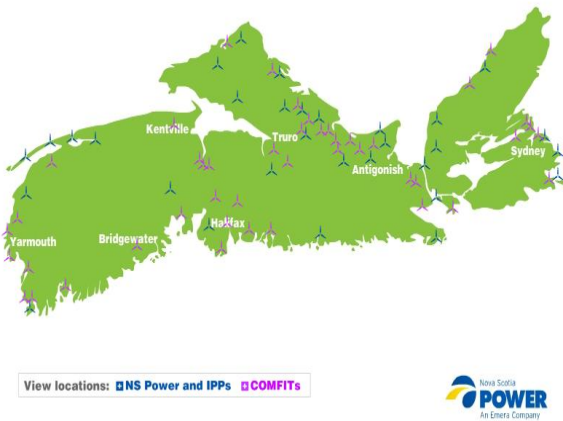
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<sup>56</sup> [www.fundyforce.ca/](http://www.fundyforce.ca/)

<sup>57</sup> [www.marinerenewables.ca](http://www.marinerenewables.ca)

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<sup>58</sup> <http://www.oera.ca/>



**Figure 15 Wind Farm Map Source: Nova Scotia Power**

According to the Canadian Wind Energy Association, Canada's wind capacity was 10.4 GW as of September 2015. A record year in terms of wind energy developments, 2014 saw 37 new wind projects added, totaling 1.9 GW of capacity. Financially, the wind energy business is expected to increase from about CAD\$290 million a year to an estimated CAD\$450 million by 2020.<sup>59</sup>

Atlantic Canada has the country's strongest winds. And, because the winds also correlate with peak demand, wind energy has become the lowest-cost option for new electricity supply.

Nova Scotia leads the region with 597 MW of onshore wind energy, developed through a unique mix of ownership models that includes independent power production, utility partnerships, and community investment.<sup>60</sup>

According to Nova Scotia Power, wind now provides from 13% - 17% of electricity in Nova Scotia. Nova Scotia Power reached its target of 28% in 2016 of renewable energy to its grid and the company estimates 40% by 2020.

Companies operating the Nova Scotia's wind power industry are local, national and international. Companies include Cape Breton Explorations Ltd., Scotia WindFields Inc., Natural Forces Inc., Renewable Energy Services Inc., Capstone Infrastructure Inc. and Shearwind. Some wind farms are operated by the municipality. International companies working in the province include Enel S.p.A., GDF SUEZ Energy North America Inc., Acciona Wind Power and Enercon. German company, IFE Eriksen, recently announced it was opening an office in Halifax to spearhead its Canadian properties.

Newfoundland & Labrador has 55 MW of wind, consisting of two utility-scale projects and one wind-diesel installation. In 2016, Copenhagen Infrastructure Partners announced that it has established a partnership with the Canadian-based developer Beothuk Energy to develop the 180MW St Georges Bay Project off the coast of Newfoundland. Ontario remains Canada's leader in clean wind energy with 4,781 MW of installed capacity, supplying approximately 5% of the province's electricity demand. Ontario also added 11 installations to the province's current wind fleet -an additional 420 MW to current generation capacity.<sup>61</sup> Alberta now ranks 3<sup>rd</sup> in Canada with an installed wind energy capacity of 1,479 MW. Companies operating in Alberta include ACCIONA, S.A., Carmanah Technologies Corp., Conergy AG, Effisolar Energy Corp., Endurance Wind Power Inc., Hitachi Canadian Industries Ltd, Partner Technologies Inc., Sequoia Energy Inc., Sustainable Energy Technologies Ltd., TransAlta Corp. and Western Wind Energy Corp.

<sup>59</sup> BP Statistical Review of World Energy 2014

<sup>60</sup> <http://canwea.ca/wind-energy/atlantic-canada/>

<sup>61</sup> <http://canwea.ca/wind-energy/ontario/>

## Hydropower

Canada is the 3<sup>rd</sup> largest producer of hydropower in the world behind China and Brazil. Canada currently has an installed capacity of about 78,000 megawatts and has the ability to more than double capacity to 160,000 megawatts.

The Robert-Bourassa generating station (formerly known as La Grande-2) is the largest hydroelectric power station in Canada, located in James Bay, Quebec. The station can generate 5,616MW. The Churchill Falls Generating Station in Newfoundland & Labrador is the 2<sup>nd</sup> largest in Canada, generating 5,428 MW. The hydropower station is a joint venture between Churchill Falls Labrador Corporation Ltd., Nalcor Energy and Quebec Hydro.

Nalcor is also in the process of building a new station on the Churchill River in Newfoundland & Labrador, Muskrat Falls. The station will generate an estimated 824 megawatts (MW), and the company will be building more than 1,600km of associated transmission lines.

Construction is set to be completed by 2018 for the underwater Maritime Link transmission line from Newfoundland & Labrador to bring Muskrat Falls' hydropower to Nova Scotia.

Nova Scotia Power owns and operates 33 hydroelectric plants on 17 hydro river systems across Nova Scotia, totaling 400 MW of generation capacity. Many plants have been providing clean, renewable electricity to Nova Scotians for decades, with some established in the early 1900s.<sup>62</sup>

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<sup>62</sup> <http://www.nspower.ca/en/home/about-us/how-we-make-electricity/renewable-electricity/hydro-station-map.aspx>

## Biomass

With Canada's ample forests, the country has great opportunities to develop its biomass industry. Biomass is becoming an attractive alternative for heating in the form of wood pellets, especially in the NWT, where it is cost-competitive with alternative heating fuels. The total installed capacity of registered wood-pellet boilers in the NWT has increased by 35% per year since 2006.

Biomass energy is expected to grow from 2.2 GW in 2014 to 3.8 GW in 2040. Most new capacity is being added in British Columbia, Ontario, Quebec and Alberta. In Ontario, two former coal-fired units were recently converted to biomass.<sup>63</sup>

In Nova Scotia, large and medium-sized pulp and paper companies use wood chips to create electricity to run their mills. Some companies sell excess power to Nova Scotia Power. The provincial energy provider also operates a 60 megawatt biomass power plant in Port Hawkesbury.<sup>64</sup>

## Nuclear

Nuclear energy accounted for 15% of total electricity generation in Canada in 2014. Following the shut-down of the Gentilly facility in Quebec in 2012, Ontario and New Brunswick are the only provinces using nuclear power to generate electricity.

## Solar Power

Canada has more than 2,500 MW of cumulative installed solar electricity generation capacity. The

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<sup>63</sup> <https://www.neb-one.gc.ca/nrg/ntgrtd/ftr/2016/index-eng.html>

<sup>64</sup> <http://www.nspower.ca/en/home/about-us/how-we-make-electricity/renewable-electricity/default.aspx>

country is one of the top-ten largest national global markets.<sup>65</sup>

Ontario is the leader for solar energy projects. Ontario has the 3<sup>rd</sup> largest solar capacity in North America after California and North Carolina. Currently, Ontario has PV capacity of over 2 GW, enough to place Canada among the top 20 solar countries worldwide.<sup>66</sup>

Canada also offers programs to promote use of solar energy. In Alberta, its government has a rebate program worth CAD \$36 million over two years to encourage rooftop solar panels on homes and businesses.<sup>67</sup> In Nova Scotia, the Nova Scotia Department of Energy is running a pilot program, "Solar for Community Buildings". The program works with eligible community groups and organizations to generate solar photovoltaic (PV) electricity on their roofs or properties and sell it to their utility under a 20-year contract.<sup>68</sup> Companies working in Nova Scotia's solar industry are members of Solar Nova Scotia, <http://www.solarns.ca/>.

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## OPPORTUNITIES

Canada ranks high on the list of top markets for renewable energy exporters, despite its comparatively small market size compared to other countries.

Best Prospects:

- Electric Motors and Generators
- Boards & Panels for Breakers and Fuses
- Electrical Transformers

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<sup>65</sup> <http://www.cansia.ca/solar-pv.html>

<sup>66</sup> <https://www.investinontario.com>

<sup>67</sup> <http://www.cbc.ca/news/canada/edmonton/alberta-announces-36m-rebate-program-for-solar-panels-on-homes-businesses-1.4002193>

<sup>68</sup> <https://novascotia.ca/solar/>

- Wind turbines, tower sections, rotor blades, casting and forgings and transformers
- Gears and generators for wind turbines
- Hydro energy turbines and equipment
- Engineering, construction, and logistics services
- Smart Grid connection and energy monitoring equipment
- Biomass systems technology transfer
- New technology for wave and tidal power generation
- Marine consulting on the environmental effects of tidal turbines
- Products and service for the Maritime Link underwater transmission cable between Newfoundland & Labrador and Nova Scotia.

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

Emissions from the combustion of fossil fuels accounted for approximately 80% of Canada's GHG emissions. In March 2016, the Canadian federal government created the Vancouver Declaration Clean Growth and Climate Change.<sup>69</sup> This declaration built upon the 2015 Quebec Declaration and Canadian Energy Strategy<sup>70</sup> and the Paris Agreement.<sup>71</sup> The Government of Canada plans to develop a strategy to achieve Canada's international commitments through a pan-Canadian framework for clean growth and climate change.<sup>72</sup> In December 2016, the Government of Canada created a national climate plan featuring a price on carbon and significant support for Canada's clean tech

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<sup>69</sup> <http://www.scics.gc.ca/english/conferences.asp?a=viewdocument&id=2401>

<sup>70</sup> <http://canadaspremiers.ca/en/initiatives/130-energy-working-group>

<sup>71</sup> <http://www.climatechange.gc.ca/default.asp?lang=En&n=E66CE373-1>

<sup>72</sup> <http://www.scics.gc.ca/english/conferences.asp?a=viewdocument&id=2401>

sector. The plan outlines federal government department strategies and funding programs.

The carbon tax will be a new tax for most provinces. Provinces have two choices: (1) a carbon tax of CAD\$10 per tonne in 2018, rising to CAD\$50 by 2022; or (2) a cap-and-trade system consistent with Canada's emissions target. The federal government's plan requires all provinces and territories to have a price on carbon by 2018.

Provincial governments have also set carbon reducing targets. Nova Scotia has legislated that 40% of its electricity be generated from renewable energy sources by 2020. The Alberta government's target is 30% of electricity in the Province be sourced from renewable sources. Newfoundland & Labrador generates more than 95% of its power from renewable resources, primarily hydro. Newfoundland & Labrador set out a GHG reduction target of 10% below the 1990 level by 2020 and then to 75-85% below 2001 levels by year 2050.<sup>73</sup>

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## FUNDING INCENTIVES

Funding in Canada for SME's derives mostly from the federal government and may be implemented by provincial governments, nonprofit groups or trade associations. As well, provincial governments offer a variety of incentives for foreign direct investment.

Foreign companies should have a Canadian partner as the lead to access Canadian funding programs.

Some federal funding incentives include:

NRCan

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<sup>73</sup> <https://www.nbc-one.gc.ca/nrg/sttstc/lctrct/rprt/2016cndrnwblpwr/prvnc/nl-lb-eng.html>

Clean Energy Fund (has been fully allocated)  
<http://www.nrcan.gc.ca/energy/funding/current-funding-programs/cef/4949>

Energy Innovation Program  
<http://www.nrcan.gc.ca/energy/funding/current-funding-programs/18709>

Sustainable Development Technology Canada (SDTC) SD Tech Fund  
<https://www.sdtec.ca/en/apply/sd-tech-fund>  
Next Gen Biofuels Fund  
<https://www.sdtec.ca/en/funding/funds/nextgen>

SD Natural Gas Fund  
<https://www.sdtec.ca/en/apply/sd-natural-gas-fund>

Business Development Bank of Canada  
Industrial, Clean and Energy (ICE) Technology  
Venture Fund <https://www.bdc.ca/en/bdc-capital/venture-capital/strategic-approach/pages/energy-cleantech-venture-fund.aspx>

National Research Council Canada  
IRAP (Industrial Research Assistance Program)  
[http://www.nrc-cnrc.gc.ca/eng/irap/services/financial\\_assistance.html](http://www.nrc-cnrc.gc.ca/eng/irap/services/financial_assistance.html)

Natural Sciences and Engineering Council of  
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[http://www.nserc-crsng.gc.ca/Business-Entreprise/FundingPrograms-ProgrammeDeSubventions/index\\_eng.asp](http://www.nserc-crsng.gc.ca/Business-Entreprise/FundingPrograms-ProgrammeDeSubventions/index_eng.asp)

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<http://www.cra-arc.gc.ca/txcrdt/sred-rsde/menu-eng.html>

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Atlantic Innovation Fund (AIF)  
<http://www.acoa-apeca.gc.ca/eng/ImLookingFor/ProgramInformation/AtlanticInnovationFund/Pages/AtlanticInnovationFund.aspx>

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<http://www.offshore-technology.com>

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Canadian Wind Energy Association

<http://canwea.ca/wind-energy/>

Statistics Canada

<http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/dsbbcan-eng.htm>

NOIA-Newfoundland & Labrador Oil & Gas  
Industries Association

[www.noia.ca](http://www.noia.ca)

Invest in Canada 2014 Renewable Energy Wind  
& Solar

Canadian Association of Petroleum Producers



# CHINA



## Country Facts

Nominal GDP	10,950 Billion USD
Population	1,361 Million
Total Trade/GDP	41.90%
Currency	Yuan (Renminbi, CNY)
Merchandise Imports from Canada	20,222.47 Million CAD
Canadian direct investment	12,410 Million CAD
Main imports	Electrical Machinery, Petrol Products, Base Metals, Industrial Supplies

## CHINA COUNTRY PROFILE

### OVERVIEW

China is the world's most populated country at over 1.3 billion people. With this large population and its growing middle class, China is also the world's largest consumer of energy. The country consumes 10.9 million barrels of oil daily. Domestically, they produce around 4 million barrels per day and 107.01 billion cubic meters of gas. China must then import approximately 60% of its oil from international markets. The amount of resource purchased, makes China a significant influencer in the energy sector.

China is also both the world's largest producer and consumer of renewable energy. Their renewable energy is generated from solar, wind, biomass and hydropower.

Figure 16 Source: EDC

### COUNTRY SOURCES OF ENERGY

Coal, is the main supply of China's energy mix, accounting for 64% of energy consumption. The second-largest is petroleum and other liquids, accounting for nearly 20% of total energy consumption. Other sources of energy are from, hydroelectric sources (8%), natural gas (5%), nuclear power (nearly 1%), and other renewables (more than 1%).

Renewables at 1% looks like a low number especially as the country is reputed as the largest consumers of renewable energy. However, this figure is attributed to the amount of people consuming the energy. Renewable energy accounts for the majority of all new capacity additions. The Chinese government invested US\$116 billion in renewable energy

transactions in 2015, the most of any country in the world.

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

In an effort to reduce heavy air pollution and the country's dependence on coal, China plans to limit coal use to 62% of its total primary energy consumption by 2020.<sup>74</sup> This target is to raise non-fossil fuel energy consumption to 15% of the energy mix and again another 20% by 2030. However, as consumption grows, so will the use of coal, the plan is to decrease coal's share of the energy mix, not the amount used.

Additionally, to increase the demand for natural gas, the government reduced the price for commercial users to better reflect market conditions. The government hopes to increase the country's use of natural gas to 10 percent.

Analysts predict that China's consumption of crude oil by the year 2020 will be 12 million barrels a day. And, by 2030, 80% of China's crude oil supply will have to be imported.

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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China has 713 oilfields and 267 gas fields. In 2015, 11 new oilfields and 10 new gas fields were put into production. China's oil and gas sector is mature and it supplies only the domestic market.

China has three established major "National Oil Companies" (NOCs) - China National Petroleum Corporation (CNPC), China Petroleum and Chemical Corporation (Sinopec), and China National Offshore Oil Corporation (CNOOC).

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<sup>74</sup>China - International - Analysis - U.S. Energy Information Administration (EIA)

CNPC is in charge of most of the country's onshore upstream assets, and Sinopec is responsible for the downstream activities such as refining, distribution, and petrochemicals; and CNOOC is responsible for the exploration and development of China's oil and gas assets in the offshore areas of China.

CNPC is the leading upstream player in China and, along with its publicly listed arm, PetroChina, accounts for an estimated 54% and 77% of China's crude oil and natural gas output. CNPC's current strategy is to integrate its business sectors and capture more downstream market share. Sinopec seeks to acquire more upstream assets to capture more value from oil and gas production and diversify its revenue sources.

CNOOC is a growing competitor to CNPC and Sinopec as the company is increasing its E&P expenditures in the South China Sea and extending its reach into the downstream sector, particularly in the southern Guangdong Province.

China also has state-owned oil firms and private companies. Sinochem Corporation, CITIC Group, and Yanchang Petroleum are relatively small state-owned firms that have expanded their presence in China's oil sector. Several independent and private companies own downstream oil infrastructure such as refineries, but their scope has remained limited by government policies that favour NOCs.

Onshore oil production in China is mostly limited to China's NOCs, but international oil companies (IOCs) have been granted greater access to offshore oil prospects. This is mostly in technically challenging onshore gas fields. IOCs offer their technical expertise in order to partner with a Chinese NOC and to gain entry into the

Chinese markets. IOCs sign production sharing contracts (PSCs) and joint venture agreements. IOCs involved in offshore E&P working in China include: ConocoPhillips, Shell, Chevron, BP, BG, Husky, Anadarko, and Eni.

### Diesel

Diesel (gasoil) is accounted for an estimated 34% of total oil products demand in 2014. Demand, however, has begun to decline for the first time in 20 years. The decline was attributed to slower economic growth, and decreased production from the coal and mining sectors that require diesel for rail and trucks. As well the country is using more efficient heavy-duty vehicles, and is driving more natural gas powered vehicles.

### LNG

According to the "China LNG Market Demand & Supply analysis, By End-User, By LNG Terminals Forecast and Opportunities, 2011 – 2021", the market for imported LNG is projected to grow by 15% through 2016 – 2021. This estimate is derived from increasing peak saving demand from residential consumers and the rising demand for integrated LNG power plants. The country has 14 natural gas based power plants with an installed capacity of 13,843.6 MWe and five operational LNG terminals. These terminals have a combined receiving capacity of 17.53 million metric tons per annum (MMTPA).

### Shale Gas

To ensure the country has stable supplies to reduce its use of coal, China has also set targets to develop its shale gas resource. China possesses the world's largest technically recoverable shale gas reserves, and has been among the first countries outside of North America to develop shale gas.

Within the last five years, China has drilled more than 600 shale gas wells and produced 4.47 billion cubic meters of shale gas. By 2040, shale gas is projected to account for more than 40% of the country's total natural gas production. This would make China the second-largest shale gas producer in the world after the United States.

However, in some ways, China's domestic shale objectives still remain elusive. Low oil and gas prices have made LNG and pipeline imports more cost effective than the development of shale resources. Shale extraction requires significant R&D and new technology. China needs to overcome technical challenges associated with its deep and complex shale formations. Their industry lacks infrastructure in remote areas, including inadequate pipelines, and scarcity of water. Large amounts of water are required to extract shale gas.



Figure 17 Oil and Gas Map Source: Platts, IEA, CNPC

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## PROJECTS

Top producing oil and gas fields are Daqing, Shengli, Changqing, Bohai, Yanchang, Xinjiang, Liaohe, Sinopec-Northwest, Tarim and Jilin.

- ConocoPhillips and CNOOC are developing the Penglai 19-3 Oilfield, the largest offshore oil reservoir so far in China; CP has a commercial equity of 49 percent. In 2015, CP reported 782 MM\$ revenues in China, down from 1,701 in 2014 (ConocoPhillips 2016).
- Husky Energy is producing natural gas with an interest of 49% from deepwater Liwan gas field since 2014 (Husky 2016).
- Shell is producing Changbei tight gas field in Shaanxi with CNPC under a 49% agreement. (CNPC-Shell2014).
- Chevron is now cooperating with CNPC in Chuandongbei natural gas field in southwest China, which initiated production in early 2016 (Chevron-AR 2016).
- BP signed a PSC with CNPC for shale gas exploration in Neijiang-Dazu shale blocks (Guo and Paton 2016).

A fresh injection of investment from the China Development Bank is financing the fourth and final leg of the Central Asia-China gas pipeline. Construction on the pipeline began in 2007, and once it is finished, it will reach an annual deliverability of 85 billion cubic metres – making it the largest gas transportation system in Asia. China is amongst one of the nations invested in Uzbekistan’s oil and gas industry.

Another company, Emyrean Energy, has received a permit for 100% of exploration rights from China National Offshore Oil (CNOOC) for Block 29/11 in the Pearl River Mouth Basina, 200km south-east of Hong Kong. During the exploration phase, Emyrean will operate the permit, which is in seabed depths of 340m-600m. The company will

acquire and complete processing and technical evaluation of 500km<sup>2</sup> of 3D seismic data.

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## GOVERNMENT REGULATIONS AND POLICIES

The Chinese government's energy policies are dominated by the country's growing demand for oil and its reliance on oil imports. The National Energy Administration (NEA) acts as the key energy regulator.

In 2011, China installed an ad valorem resource tax of 5% on all oil and gas production, including unconventional resources output, in an attempt to increase revenues for local and regional governments, and to encourage more-efficient hydrocarbon production. The resource tax was raised to 6% in late 2014, although the tax rate was lower for projects using certain enhanced oil recovery (EOR) techniques or containing high sulfur or heavy oil.<sup>75</sup>

In oil and gas, China's NOCs must hold the majority participating interest in product sharing contracts and can become the operator once development costs have been recovered.

Foreign developers in the offshore wind industry are only allowed a minority share, up to 49% of Chinese offshore projects.<sup>76</sup>

Chinese laws and regulations for the energy sector are noted as vague or poorly defined. It could be difficult for foreign firms to determine whether their activities are in accordance with regulations. It is important for IOCs and exporters to hire an energy consultant to help navigate regulations.

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<sup>75</sup>[https://energy.gov/sites/prod/files/2016/04/f30/China\\_International\\_Analysis\\_US.pdf](https://energy.gov/sites/prod/files/2016/04/f30/China_International_Analysis_US.pdf)

<sup>76</sup> [trade.gov/topmarkets/pdf/Renewable\\_Energy\\_China.pdf](http://trade.gov/topmarkets/pdf/Renewable_Energy_China.pdf)

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## CERTIFICATION AND STANDARDS

Most companies operating in China have passed ISO 9000 QMS certificates, and most of their products are API and ASME certified.

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## WORKING IN CHINA

Market Strengths:

- Country is seeking to rebalance the economy away from investment-led growth and towards consumption
- Country is considering to further open up the oil and gas exploration sector to private-sector investment
- Largest country in the world by population with over 160 cities of more than a million inhabitants
- Fast growing consumer market resulting from increasing number of middle income consumers
- Growth ensured by Chinese monetary policy
- Forecast to become the world's largest luxury goods market by 2020

There are many export barriers for doing business in China that Nova Scotia companies need to take into consideration.

Market Challenges:

- Large parts of the economy are still closed to full foreign participation
- Strong competition from well-resourced and positioned state-owned enterprises
- Finding and retaining the right skills in the local workforce
- Complex business culture
- Language barriers
- Need for patience to build up trust and networks
- Significant time difference

- Weather extremes across the country and high levels of pollution in certain urban centres
- Anti-monopoly legislation in relation to foreign firms
- Patience in finding the right partners and establishing relationships
- Poor intellectual property rights
- Lack of transparency of the regulatory environment
- Corruption with the tendering processes

China is not one single market, as indicated by the oil and gas map. Exporters will need to understand the regional economic and cultural differences when working in China. Nova Scotia companies should consider using export agents or distributors in China and partner with an international company with experience working in China.

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### MAJOR COMPANIES

Chinese National Petroleum Corporation (CNPC)  
Sinopec  
Chinese National Offshore Oil Corporation  
(CNOOC)  
Yanchang Petroleum  
China Shenhua Energy  
China Huadian Corporation  
Huaneng Power International, Inc.  
Beijing Enterprises Holdings  
South Sea Petroleum Holdings Limited  
Offshore Oil Engineering Co., Ltd.  
Mongolia Energy Corporation  
Shenergy Group Company Limited

Industry trade association is China Petroleum & Petrochemical Equipment Industry Association (CPEIA) <http://www.cpeia.org.cn/en/index.shtml>

The Association has approximately 900 members.

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Karamay, Daqing and Dongying are the three membership cities of the World Energy City Partnership.

At present, IOCs mostly team up with CNOOC in offshore oil development projects. Service companies often work on both onshore and offshore projects, which include complicated and complex drillings. IOCs and international service companies have started working with Sinopec, PetroChina and Yanchang to develop shale gas and tight oil and gas in Sichuan, the Erdos Basin, and Xinjiang.

The best opportunities in China are in sectors where domestic companies do not have the capacity and where there is government support.

### Best Prospects

#### Equipment:

- Parts for sinking and boring machinery
- Positive displacement pumps

#### New oil and gas exploitation technologies:

- Steam-assisted gravity drainage (onshore)
- Geologic exploration equipment, position
- Navigation systems
- Deep-water drill systems (offshore)

#### Shale Gas:

- Fracturing technology
- Water efficiency
- Deep extraction technologies

#### Unconventional Gas:

- Technologies and expertise in tight gas, coal-bed methane and coal gasification

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## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

As the world's largest importers of oil and gas, falling prices are actually good for the Chinese economy. The Chinese government is able to fill its strategic petroleum reserve with inexpensive foreign crude oil. However for the producers, lower prices have forced CNOOC and Sinopec to decrease capital expenditures and reduce production from high cost wells.

## RENEWABLE INDUSTRY

Driving the renewable energy industry in China is the population demand. Yet China is not without its issues in delivery. Increased capacity of the renewable industry has not led to increased power generation. Some clean power has been left idle due to transmission bottlenecks, particularly in the northern and western provinces. The Chinese Government took aggressive steps to remedy this situation in March 2016. They ordered power transmission companies to provide grid connectivity for all renewable power generation sources that meet the technical standards.

China's renewable energy industry also lacks coordinated planning to ensure sufficient feedstock supplies, power grid accessibility, and efficient distribution of projects. For example, biomass projects are often built too close together resulting in a lack of sufficient inputs, and lack of coordination between wind power producers has resulted in inefficient use of high-value land.<sup>77</sup>

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<sup>77</sup> <http://www.ccbc.com/zh-hant/research-reports-2/sectoral-research/clean-energy-sector/>

## Solar Power

China is the largest producer of solar technologies, supplying 70% of solar panel demand to their country.

China installed over 15 GW of new photovoltaic capacity in 2015, accounting for quarter of global solar installation. China is also very ambitious in developing Concentrated Solar Power (CSP) and established a 10 GW target during the 13th Five-Year Plan period. China's National Development and Reform Commission is expected to announce a Feed-in-Tariff rate for CSP, which should drive investment into the country.

## Wind Power

There are approximately 1013 wind farms in China, both onshore and offshore. Chinese importers often base their purchasing decisions on upfront price, reducing the competitive position of international suppliers. IOCs base their pricing on long-term quality and lifetime cost. Companies who have installed wind power projects often see their expected profits evaporate when local pricing has been less than anticipated.<sup>78</sup>

Despite initial industry excitement over a potential Chinese offshore wind market, analysts do not expect large-scale developments in the short term. This is due to opaque offshore regulations, high development costs, lower returns, and grid limitations. In fact, China missed its 12th Five-Year Plan target of 50 GW for offshore wind projects. In June 2014, China's National Development and Reform Commission (NDRC) released its long-awaited feed-in-tariff for offshore wind, but the new NDRC scheme offered prices that were the lowest in the world,

making other offshore markets far more attractive.

The largest domestic wind turbine manufacturer in China is Goldwind, the company constructs 19% share of new installations. It is followed by Guodian United Power Technology Company (a subsidiary of China Guodian Corporation) at 11%, and Mingyang Wind Power at nine percent.

Wind farm manufacturers in China:

- AVIC Huide
- China Creative Wind Energy
- CNYD
- CSR
- DEC
- Envision
- GC China Turbine Corp
- Goldwind
- Guangdong Mingyang
- Guodian
- Hewind
- HZ Windpower
- Jiangsu Naier Wind Power Technology Development
- Sany
- Shandong Swiss Electric
- Shanghai Electric
- Shanghai Wande Wind Power
- Sinovel
- Tianwei Baobian Electric
- Windey
- Yinhe

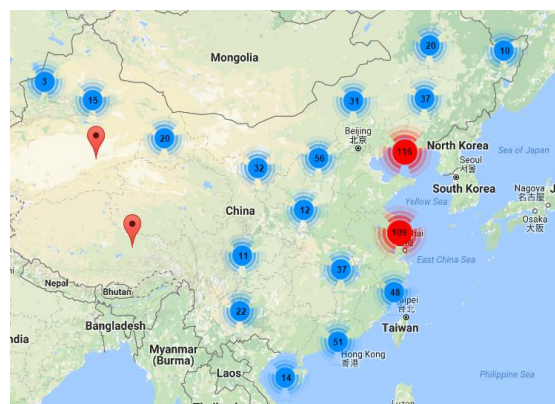


Figure 18 Wind Map Source: The Wind Power

<sup>78</sup> Canada Chinese Business Council

## **Hydropower**

Hydropower is a priority for China's infrastructure investment funds. Approval for projects is relatively easy compared to other markets. By the end of 2015, China's hydropower installed capacity reached 319 GW, with an annual generating capacity of 1.11 trillion kWh. The volume of China's installed capacity and power generation rank first in the world. China's domestic companies dominate its main component market.

## **Biofuels/Biomass**

China's biofuels and biomass capabilities are currently in early stages of development, and while challenges remain, it offers significant potential. An estimated 1.5 billion tons per year of waste agriculture and forest materials are generated each year.

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

### **Wind Power**

China often imports or licenses critical components for its wind industry. Moreover, the country is shifting towards small and medium-sized wind farms. The industry will need increased technical and safety standards, newer technologies, innovative products and technical components.

IOCs should consider viewing the Chinese renewable energy market by region or province, with each distinct location offering different opportunities. The resource-rich west, including Xinjiang, Qinghai, and Gansu, has been targeted by the Chinese Government for increased renewable energy development and will likely be the location of many projects going forward.

The eastern and southern manufacturing centres, while not the location of most renewable energy projects, are often where component manufacturers and developers can find buyers for their products and services.

The third region, the transmission constrained north, may be an area for distributed generation, but at this point should not be targeted as a region of particular potential.

## **Hydropower**

Opportunities for exporters in this market are in creating control systems and environmental consultancy services.

## **Asian Development Bank (ADB)**

To enter this market, Nova Scotia companies should review projects with the ADB that have been approved and proposed.

<https://www.adb.org/projects/search/country/prc/status/proposed>

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

In March 2015, China unveiled its 13th Five-Year Plan, to reduce its dependency on coal and increase environmental technologies and renewable energy. The plan's focus on energy is centered on expansion in wind and solar power generation, doubling wind's level and quintupling solar's level from the previous Five-Year Plan.

Wind projects approved by China's National Development and Reform Commission discontinued domestic requirement in Wind Power in 2009. However, Chinese wind turbine manufacturers receive other forms of government support, including cheap land, low-interest government loans and preferential



contracts from government-owned power generation companies.<sup>79</sup>

China's government has provided a 5% preference to domestic firms during the bidding process for wind concessions and has imposed technical and other procedural conditions on the foreign firms in order to compete for the wind concession. Due to the above conditions, foreign firms in China face difficulties in receiving wind farm concessions, despite their high competitive bids.<sup>80</sup>

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## FUNDING INCENTIVES

Asian Development Bank climate change initiative has funding which Nova Scotia may access. Nova Scotia companies should contact their Global Affairs Canada representative for assistance with working with international financial institutions (IFI's).

### Programs with the ADB

Clean Energy Funds and Partnerships, namely:

- Clean Energy Financing Partnership Facility (CEFPF)
- Climate Change Fund (CCF)
- Renewable Energy, Energy Efficiency, and Climate Change (REACH)

Funding through Climate Change Initiatives, namely:

- ADB Climate Change Fund (CCF)
- Urban Climate Change Resilience Trust Fund (UCCRTF)
- Integrated Disaster Risk Management Fund (IDRM Fund)
- Future Carbon Fund (FCF)

Funding through Energy for All Partnerships:  
Asian Development Bank:

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<sup>79</sup> [www.sustainableprosperity.ca](http://www.sustainableprosperity.ca)

<sup>80</sup> <http://www.power-technology.com/features/feature119046/>

<https://www.adb.org/>

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ITE Oil and Gas <http://www.oilgas-events.com/market-insights/global-developments/7-oil-gas-projects-to-watch-in-2016/801810815>

Lei Wang, PhD Petroleum Engineering, China's crude oil and natural gas industry, Colorado School of Mines August 17, 2016

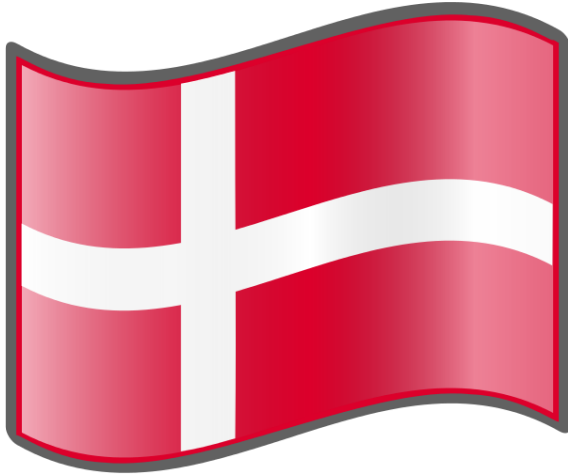
Canada Chinese Business Council  
<http://www.ccbc.com/zh-hant/research-reports-2/sectoral-research/clean-energy-sector/>

WIPO Green

<https://www3.wipo.int/wipogreen/en/network/funding.html>

**Notes:**

# DENMARK



## Country Facts

Nominal GDP	295.16 Billion USD
Population	5.67 Million
Total Trade/GDP	100.18%
Currency	Danish Krone (DKK)
Merchandise Imports from Canada	341.81 Million CAD
Canadian direct investment	136 Million CAD
Main imports	Machinery & Equipment, Food, Beverage & Tobacco, Chemicals, Mineral Fuels

## DENMARK COUNTRY PROFILE

### OVERVIEW

Denmark is one of the European Union's (EU) leading oil producers and the only net exporter of oil in the EU. Danish oil reserves and production are located in the Danish sector of the North Sea.

Denmark is also one of the leading countries in the EU for renewable energy development. The country is a trail blazer in developing renewable energy from biomass and wind power.

### COUNTRY SOURCES OF ENERGY

Energy efficiency has been a priority for Denmark for decades. The country has been reliant on imported coal its main source of energy, however, coal fired power plants in

### Figure 19 Source: EDC

Denmark will be phased out in 2021.<sup>81</sup> Other sources of the country's energy are from oil and natural gas (4%). After fossil fuels are phased out, the country plans to utilize biomass and wind as its prime energy source. Currently, 70% of renewable energy consumption in Denmark comes from biomass, mostly in the form of straw, wood and renewable wastes. The remainder of the renewable energy is generated from geothermal, wind power and solar energy. More than a third of the Danish electricity production derives from wind turbines. Denmark also imports nuclear energy from Sweden and Germany.

<sup>81</sup> <https://stateofgreen.com/en/news/denmark-s-coal-fired-power-plants-by-and-large-phased-out-in-7-years>

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## CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

Denmark is one of the most energy efficient countries in the EU. Electricity consumption forecasts estimates an increase in the electricity consumption of 7.8 TWh or 23% by 2025. Part of the increase in the electricity consumption towards 2025 can be explained by a gradual introduction of electric boilers, heat pumps and electric vehicles.<sup>82</sup>

Natural gas supplies from the North Sea have declined in recent years, but production is expected to increase marginally again in 2017 and for some years ahead. The gas supply will be from new field development as supplies from existing fields are dwindling.

In addition to the North Sea, Denmark plans to cover its demand for natural gas by importing natural gas from Germany and Sweden until 2020. After 2020, expected gas demand in Denmark will be covered solely by the North Sea and the remainder of energy will be supplied by renewable resources.

The country plans to be 100% independent of fossil fuels by 2050. The European Renewables Directive set a mandatory target at 20% share of energy from renewable sources by 2020 (EU combined). In 2012 the Danish government adopted a plan to increase its share of electricity production from wind to 50% by 2020 and then to 84% in 2035.

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<sup>82</sup> <http://www.energinet.dk/EN/KLIMA-OG-MILJOE/Miljoerapportering/Sider/Forbrug-i-Danmark.aspx>

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## ENERGY INDUSTRY

### OIL AND GAS

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The Danish part of the North Sea is considered a mature area. Nevertheless, there are still new exploration prospects and existing exploration targets. Oil production has been steady over the past few years, producing more than 215,000 barrels of oil per day, yet production is expected to decline during the next three to five years.

In total, oil production accounts for roughly DKK 40 billion (US\$7.3 billion) per year and gas production for about DKK 10 billion (US\$2 billion) per year. After a long period of falling oil prices, the prices in Denmark have now started to rise as a result of a global growth. This has caused an increase in the demand for oil, but there still is a decrease in production.

There are 19 producing fields in Denmark. Fifteen are operated by Maersk Oil and one field is operated by Hess. Three fields were operated by DONG, which is now in the process of being sold to Ineos.<sup>83</sup> The five largest oil producing fields are Halfdan, Dan, Gorm, and Skjold, owned by the Danish Underground Consortium (DUC), which is Maersk, Shell and Chevron, and operated by Maersk. The South Arne field is owned primarily by Hess and operated by Hess. These five fields alone produce approximately 80% of the country's total oil.

Maersk Oil issued a notification to the Danish gas market late December 2016 that an economically viable solution for full recovery of the remaining resources in the Tyra field has not yet been identified, and that production from the Tyra field is consequently expected to cease October 2018. Tyra is Denmark's largest gas

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<sup>83</sup> <http://www.telegraph.co.uk/business/2017/05/24/ineos-snaps-dong-energys-north-sea-assets-1bn-deal/>

field and the facilities are the processing and export centre for all gas produced by DUC. More than 90% of Denmark's gas production is processed through the facilities. Tyra East and Tyra West is also the hub for a number of smaller facilities in the Tyra field. This includes the neighbouring unmanned facility, Tyra Southeast, which was extended in 2015.<sup>84</sup>

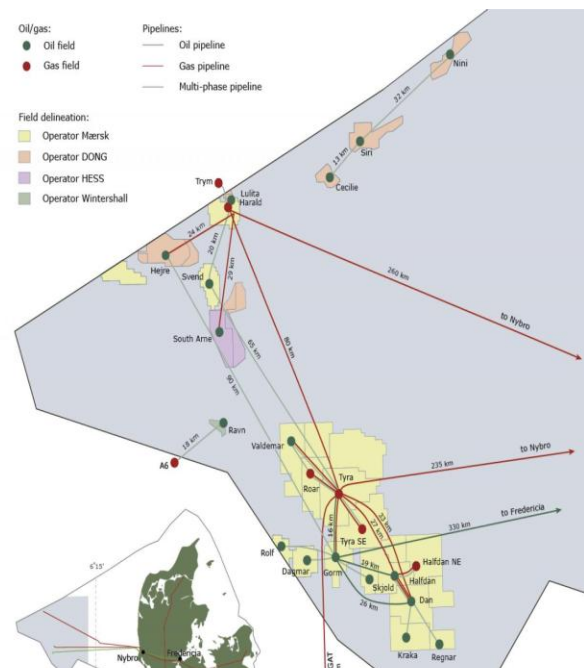
Oil production from the North Sea is an important source of financing for Denmark, but production requires increasingly high energy-intensive recovery methods. As the industry peaks, the country is looking towards expanding exploration into the northern regions of Greenland.

## PROJECTS

- German upstream company DEA Deutsche Erdoel has been offered two licences in offshore Denmark by the Danish Energy Agency, as part of the 7<sup>th</sup> licensing round. DEA is now an operator in Denmark and has a 50% interest in each of the licences 8/16 and 9/16.
- Hansa Hydrocarbons has secured two new offshore licences under the Danish 7<sup>th</sup> licensing round in the North Sea. The licences 7/16 and 14/16 remain subject to clearance by the Danish Parliament.
- DONG Energy has agreed to support the joint industry project Optimizing Oil Production by Novel Technology Integration (OPTION), which aims to tackle the challenges of oil recovery from reservoirs.
- In 2015, Total abandoned work at its exploration well Vendsyssel-1 in north-western Denmark. The company has stopped exploration activities saying that the gas discovery is too thin for commercial development.

## GOVERNMENT REGULATIONS AND POLICIES

The Danish upstream oil sector, as well as natural gas exploration and production, is governed by the Danish Subsoil Act. Under the Act, the state grants a licence to the licensee for investigations, exploration and production. The licence is regulated by the state under the Subsoil Act, which means that all substantial activities in all phases of investigation, exploration and production require a separate approval from the government.



**Figure 20 Oil and Gas Map, North Sea Source: Danish Energy Agency**

The Danish Energy Authority's (DEA) approval of new development plans is conditional upon the operators' choosing the Best Available Techniques (BAT), when this is financially reasonable. This means that in each individual case, the operators must investigate the potential for using more energy-efficient alternatives.<sup>85</sup>

<sup>84</sup><http://www.maerskoil.com/media/newsroom/pages/engineeringthefutureofthetyrafieldstartsjanuary2017.aspx>

<sup>85</sup> <https://www.export.gov/article?id=Denmark-Oil-and-Gas-Field-Machinery>

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## CERTIFICATION AND STANDARDS

BOSIET, or basic offshore safety instruction and emergency training are required in Denmark.<sup>86</sup>

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## WORKING IN DENMARK

Market Strengths:

- Easy access to northern Europe markets via Copenhagen hub airport and high quality motorway network
- Well educated population with a high proportion of university graduates
- Advanced telecommunication infrastructure
- Denmark is an industrialized “value-added” country, dependent on foreign supplies of most raw materials and semi-manufactured goods
- Takes only 24 hours to establish a company online
- Corporate taxation is among the lowest in the EU (22% in 2016)
- Expansion opportunities to Greenland

Market Challenges:

- Mature energy industry with established companies
- Danish wages are high and personal taxes are among the highest in the world
- Danes prefer to buy products that proven their technology and value
- Danes prefer to do business with those who they have established relationships

### **Employees on moveable oil rigs, drill ships, etc.**

Nova Scotians can be granted a residence and work permit to work on an oil rig, drillship or other comparable movable work stations

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<sup>86</sup> <http://work.chron.com/certification-need-work-oil-rig-29574.html>

temporarily situated on Danish territory. It is normally a condition that prior to working on Danish territory, to have had similar employment on the moveable work station or that the employee has previously been employed in a similar position with the foreign company. Workers will be granted a residence and work permit for the limited time period that the moveable work station is situated on Danish territory (usually one to three months). A permit cannot be granted for longer than six months.

Canadian passport must be valid for at least three months beyond the duration of the residence permit.<sup>87</sup>

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

World Energy Partnership City member, Esbjerg, is recognized as the Energy Metropolis of Denmark.

Denmark estimates there will be four to six new wells drilled in the North Sea. For current extraction, the mature fields require water and gas injection to maintain pressure. With the oil, an increasing amount of water is produced that must be treated before being discharged into the sea or re-injected. Technologies to improve this process will be an opportunity for exporters. Exploration and production activities will also require imports.

With the purchase of DONG assets by INEOS, if the Heyron project proceeds, Heyron is a high-pressure, high-temperature well and will required companies experienced working in this discipline.

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<sup>87</sup> [https://www.nyidanmark.dk/en-us/coming\\_to\\_dk/work/Employees-on-moveable-oil-rigs-drillships.htm](https://www.nyidanmark.dk/en-us/coming_to_dk/work/Employees-on-moveable-oil-rigs-drillships.htm)

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## MAJOR COMPANIES

Maersk  
HESS  
Shell  
Chevron  
INEOS

There are approximately 120 Danish suppliers in the global oil and gas industry. They can be found with the Danish Oil and Gas Technology Group.

<http://www.dk-export.com/suppliers/>

Best Prospects:

- Engineering
- Fabrication
- Consulting
- Crewing
- Shipping
- HPHT well experience

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## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

In 2016, Maersk posted a net loss for the first quarter of 2016 mainly due to low oil prices. Maersk Oil reduced operating expenses by 21% excluding exploration costs, to US\$570m, compared to US\$724m in the previous year. Further initiatives to address cost reductions are being executed, including extensive re-contracting to take advantage of the softening market as well as strengthening of the procurement process.

Maersk had over 1,300 job losses; the company implemented a salary freeze in 2016, reduced travel expenses and initiated the outsourcing of administrative functions to a shared service centre in India.<sup>88</sup>

## RENEWABLE INDUSTRY

Denmark is the world leader in cleantech and low carbon related industries. Danish companies control one third of the global wind market and are the world leaders in supply chain technologies to the wind industry.

In general, it has been difficult for Canadian companies to penetrate the clean technologies market (with the exception of fuel cell/battery technology) due to domestic Danish competencies and strong competition from neighbouring countries Germany and Sweden. However, CETA tariff reductions may provide Canadian cleantech suppliers with a competitive edge for future Danish projects.<sup>89</sup>

### Biomass

The consumption of biomass for energy production in Denmark more than quadrupled between 1980 and 2009. Biomass has made a significant contribution to reducing Danish CO2 emissions. Moreover, due to the extensive use of bioenergy, there is an abundance of expertise available in Denmark in this field. In addition to hosting several top-efficient, full-scale biomass plants, Denmark is an industry hub and testing ground for modern energy technologies based on biofuels and biogas. Danish

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<sup>88</sup> <http://www.offshoreenergytoday.com/maersk-oil-sinks-to-red-on-low-oil-price/>

<sup>89</sup> <http://tradecommissioner.gc.ca/denmark-danemark/market-facts-faits-sur-le-marche/0000862.aspx?lang=eng&pedisable=true>

companies and universities cooperate closely to offer world-class biobased solutions.

DONG Energy entered into heat agreement with the power supply companies VEKS and Metropolitan Copenhagen Heating Transmission Company (CTR). DONG Energy will convert Unit 2 at Avedøre Power Station, raising its current 80% biomass production to a 100% production based on wood pellets. Total investment for the extension amounts to approximately DKK 100 million.<sup>90</sup>

### Wave Power

Wave power is a promising, but yet immature technology for Denmark's renewable electricity. Denmark is hosting four demonstration plants at sea based on different concepts. Three wave power plants with permissions to test in Danish seas and one developer with permission to do pre-investigations to prepare an area for future wave energy plants.

The development work in Denmark is currently focusing on technology concepts and conducting sea tests of large scale models. Another promising development perspective is synergy effects with offshore wind farms.

Danish active projects:

- NEMOS - Nissum Bredning
- Leancon Wave Energy
- Wavepiston
- DanWEC - Hansholm Harbour

Companies involved in wave power include Crestwing ApS, Wavepiston ApS, and Erik Friis-Madsen.

<sup>90</sup> <http://www.besustainablemagazine.com/cms2/denmark-state-of-green/>

### Wind Power

Wind power is one of the most widespread types of renewable energy in Denmark. Denmark was a pioneer in developing wind power and has installed wind turbines onshore since the 1970's.

Denmark and Danish companies rank among the best when it comes to development, production and installation of wind turbines. Export of wind turbines and technology for wind energy is an essential contribution to the Danish economy.

The biggest wind turbine manufacturers with production facilities in Denmark are commercial Vestas and Siemens Wind Power. Others manufacturers are sold to households: Gaia-Wind Ltd., Zenia Energy, NEG Micon, Micon, HSWind Aps, Solid Wind Power A/S, Nordtank, Kongsted, Ukendt, Wind World, Norwin, THY møllen Aps, Danwin, Reymo, Nordtank, POULSEN, Sonebjerg, Ukendt, Tellus, Wincon, HSWind Aps.

DONG Energy is a major player in Europe's offshore wind industry. More than one-third of all offshore wind capacity is built by the Danish utility company. DONG aims is to quadruple its installed capacity by 2020.

A new development is Vattenfall which will have both onshore and offshore wind parks.

### Established Offshore Wind Farms

Wind farm	Owner
Anholt	DONG, others
Horns Rev II	DONG
Rødsand II	E.ON
Nysted (Rødsand I)	DONG 50%, PensionDanmark 50%
Horns Rev I	Vattenfall 60%, DONG 40%
Middelgrunden	50% private, 50% DONG
Samsø	Municipal, private



Wind farm	Owner
Sprogø	Great Belt Link
Rønland 1	THV (Vestas), Dansk Vindenergi ApS (Bonus)
Avedøre Holme	50% DONG, 50% private
Frederikshavn	DONG
Tunø Knob	DONG
Vindeby	DONG

In total, there are approximately 1531 wind farms offshore, nearshore and onshore in Denmark. In addition to the offshore projects, a further 500 MW additional net capacity of onshore wind farms is expected to be constructed by 2020. The 500 MW of additional net capacity is the expected result of the scrapping of 1,300 MW capacity from obsolete wind turbines combined with the simultaneous building of 1,800 MW capacity of modern wind turbines, a process also known as repowering.<sup>91</sup>

For a full list of the wind farms: <https://ens.dk/en/our-services/statistics-data-key-figures-and-energy-maps/overview-energy-sector>

Project Announcements:

- In December 2016, A2SEA was awarded an engineering consultancy services contract to marine and engineering consultancy firm Aqualis Offshore for installation work at the Horns Rev 3 wind farm offshore Denmark. Under the contract, Aqualis Offshore will provide structural site assessments at the wind farm, where A2SEA's Sea.
- December 2016, DONG Energy Wind Power A/S contracted Nexans to supply and terminate a total of 139km of three-phase subsea cable for the first of three construction phases of the Hornsea

<sup>91</sup>[https://en.wikipedia.org/wiki/Wind\\_power\\_in\\_Denmark#Offshore](https://en.wikipedia.org/wiki/Wind_power_in_Denmark#Offshore)

Project One wind farm, located off the Yorkshire coast.

- June 2016, SAL Heavy Lift GmbH signed a contract with Dutch Offshore WindForce, a joint venture between Boskalis and Volker Stevin International, for the transport of 67 transition pieces. The Transition Pieces are destined for the Veja Mate Offshore Wind farm located in the German North Sea some 95km north-west of Borkum Island.

## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Best Prospects:

- Engineering composites
- Operations and maintenance (O&M)
- Wave power consulting

Tech transfer in wind energy is a possibility for Nova Scotia.

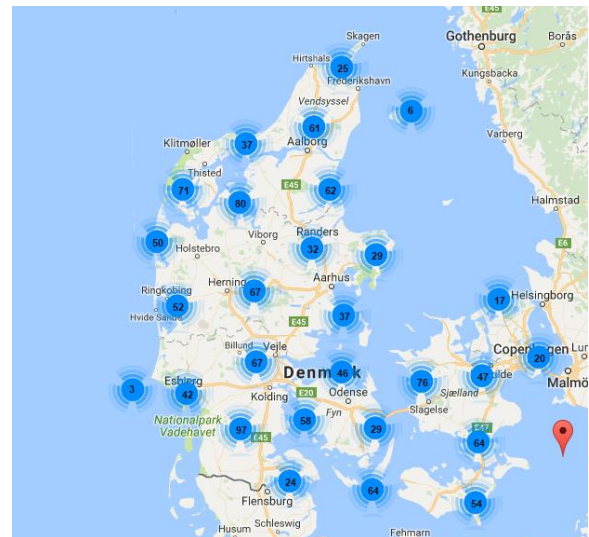


Figure 21 Wind Map Source: The Wind Market

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

The Danish Energy Agreement 2012-2020<sup>92</sup> stipulates that half of the country's electricity consumption will come from wind power, enabling a share of 35% renewable energy in gross energy consumption in 2020. Moreover, the energy consumption is to decrease by more than 12% in 2020 compared to 2006.

Particulars Include:

- That the increased efforts within the energy savings area made by energy companies are to be financed via the tariffs on energy distribution;
- That funding for expanding renewable energy that is supplied to the electricity and gas grids is to be financed via PSO (Public Service Obligation) schemes and thus via the energy bill;
- That a security of supply tax on space heating is to be introduced to cover government funding for biogas, industrial CHP, energy savings packages in privately owned rental properties, renewable energy in businesses, as well as the government's loss of taxes due to lower consumption of fossil fuels; and
- That a share of the security of supply tax is to be offset against lower energy taxes on electricity and fuel for industry with a view to maintaining Denmark's competitiveness.

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<sup>92</sup><https://www.iea.org/policiesandmeasures/pams/denmark/name-42441-en.php>

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## **FUNDING INCENTIVES**

Energy Technology Development and Demonstration Programme (EUDP)<sup>93</sup>

EUDP provides opportunities for SMEs and large companies as long as the company is connected to the energy sector or have a desire to enter into the industry. The key factor is that the company or consortium has a project idea which focuses on resolving an energy technological problem. With EUDP, companies can receive co-financing for projects encompassing the development and/or demonstration of new and efficient energy technologies, research projects directly improving or supporting demonstration activities, and development of public-private partnerships for energy technology.

Nova Scotia companies must partner with a Danish company or organization as the lead.

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## **OTHER SOURCES OF INFORMATION**

US Commercial Service

<https://www.export.gov/article?id=Denmark-Oil-and-Gas-Field-Machinery>

International Cooperative Legal Guides

<https://www.iclg.co.uk/practice-areas/oil-and-gas-regulation/oil-and-gas-regulation-2017/denmark>

Danish Energy Agency

<https://ens.dk/en>

Department for International Trade UK

<https://www.gov.uk/government/publications/exporting-to-denmark/exporting-to-denmark>

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<sup>93</sup>[http://www.investindk.com/~media/Files/Sheets/Framework%20conditions/Funding\\_and\\_Financial\\_incentives\\_2016.ashx](http://www.investindk.com/~media/Files/Sheets/Framework%20conditions/Funding_and_Financial_incentives_2016.ashx)

Ministry of Foreign Affairs Denmark – Funding Incentives 2016

The Wind Power

[http://www.thewindpower.net/country\\_maps\\_en\\_6\\_denmark.php](http://www.thewindpower.net/country_maps_en_6_denmark.php)

Wikipedia

[https://en.wikipedia.org/wiki/Wind\\_power\\_in\\_Denmark#Offshore](https://en.wikipedia.org/wiki/Wind_power_in_Denmark#Offshore)

Government of Denmark – Danish Energy Agency

<https://ens.dk/ansvarsomraader/vindenergi/eksisterende-havvindmoelleparker-og-aktuelle-projekter>

terende-havvindmoelleparker-og-aktuelle-projekter

Canadian Trade Commissioner Service

<http://tradecommissioner.gc.ca/denmark-danemark/market-facts-faits-sur-le-marche/0000862.aspx?lang=eng&pedisable=true>

**NOTES:**

# KAZAKHSTAN



## KAZAKHSTAN COUNTRY PROFILE

### OVERVIEW

Kazakhstan is the 9<sup>th</sup> largest country in the world and across its vast expanse, one of the most sparsely populated.

Globally, the country ranked 11<sup>th</sup> in terms of proven oil reserves, producing nearly 1.7 million barrels per day (bbl/d) in 2014. Kazakhstan is also in control of the Caspian Sea's largest recoverable crude oil reserves.

The Government of Kazakhstan and foreign investors continue to focus heavily on the hydrocarbons sector which receives approximately 60% of the country's foreign direct investment. The government has ambitious plans for its renewable energy sector; however, they have challenges with financing and infrastructure. Foreign investment will be critical for the country to attain its renewable energy goals.

### Country Facts

Nominal GDP	173.39 Billion USD
Population	17.63 Million
Total Trade/GDP	56.51%
Currency	Kazakhstan Tenge (KZT)
Merchandise Imports from Canada	117.16 Million CAD
Canadian direct investment	2,512 Million CAD
Main imports	Machinery & Equipment, Mineral Products, Chemicals, Metals

Figure 22 Source: EDC

### COUNTRY SOURCES OF ENERGY

Coal is the predominate source of energy at 72 percent. Hydropower accounts for 12%, oil 10.5%, natural gas 5% and less than 1% in renewable resources.

As of 2014, there were 76 electrical generation stations with a total capacity of 20,591.5 megawatts, including: thermal plants – 10002.4 MW; hydropower plants – 2,583 MW; wind power plants – 5.6 MW; and solar power plants – 0.5 MW.

However, the efficiency of Kazakhstan's power generation stations is low. Long distances between stations and population clusters account for some of the inefficiency, but the main cause of the bungling is the aging equipment. The equipment is reportedly over 30-years-old and from the Soviet era.

Kazakhstan's power industry is divided into three regions: North, South, and West:

The North consumes about 70% of Kazakhstan's total energy, and produces about 79% of the country's total. Northern energy is produced at coal and hydro power plants.

The West produces energy through associated gas power stations and natural gas. The West is energy self-sufficient, both producing and consuming 11% of Kazakhstan's energy.

The South produces 10% of the country's energy at its thermal power stations which are powered by coal and gas. The South consumes 17% of Kazakhstan's energy, in part by importing electricity from the North, which is over 1,000 kilometers away.

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

The Ministry of Energy oversees the oil and gas industry in Kazakhstan. In 2014, the government reorganized to create a more compact and effective government.

Many of the country's fields are mature and in decline. Fortunately, in 2016 the Kashagan field, which had been shut down, resumed operations and is expected to produce up to 1.1 million tonnes of oil in 2017 and 4.0-8.0 million tonnes in 2018.<sup>94</sup>

The country also recognizes that it needs to upgrade its infrastructure. The government plans to build 14-15 new hydropower plants to improve the power grid.

The government created the Kazakhstan 2050 Strategy for all aspects of the country's "green"

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<sup>94</sup>[http://www.rigzone.com/news/oil\\_gas/a/147490/kazakhstan\\_giant\\_kashagan\\_oil\\_field\\_begins\\_commercial\\_output](http://www.rigzone.com/news/oil_gas/a/147490/kazakhstan_giant_kashagan_oil_field_begins_commercial_output)

economy. The government seeks to reduce green house gas emissions by 25% by 2050 and promises to use renewable and alternative energy sources to create 50% of the electric capacity generated. The country wants to become a model green economy. This strategy includes measures for water resource conservation, agriculture and waste management. Kazakhstan plans to be the first Commonwealth of Independent States (CIS) country to launch a cap and trade system to curb greenhouse gas emissions.<sup>95</sup>

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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Kazakhstan's estimated total petroleum and other liquids production was 1.70 million barrels per day (bbl/d) in 2014. The nation's current oil production is dominated by two giant onshore fields in the northwest of the country: Tengiz and Karachaganak. These fields produce about half of Kazakhstan's total petroleum. The offshore Kashagan field in the Caspian Sea will also play a major role in Kazakhstan's liquid production in the coming years.

KazMunaiGas (KMG) is Kazakhstan's national oil company. It was created in 2002 and holds equity interests in Karachaganak (10%), Kashagan (16.8%), and Tengiz (20%), as well as interests ranging between 33% and 100% in many other production projects.

The Kashagan field, with an estimated 7-9 billion barrels of recoverable oil, was expected to come on stream by the end of 2013. However, in September of that year, a routine inspection of the gas pipeline, running from Island D to the Bolashak Unit, revealed a gas leak. The Kashagan field was shut down for repairs to its

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<sup>95</sup> <http://kzgreenenergy.com/>

200 kms of pipeline, and oil production was suspended. Commercial production at Kashagan resumed in 2016. The offshore field has produced about 0.5 million tonnes (3.8 million barrels) of oil since test pumping began on Sept. 28, 2016 and daily output has exceeded 75,000 barrels since Nov.1, 2016.<sup>96</sup>

Kashagan is developed by North Caspian Operating Company (NCOC) and its shareholders are Agip Caspian Sea B.V. KMG Kashagan B.V., ExxonMobil Kazakhstan Inc., Inpex North Caspian Sea Ltd., Shell Kazakhstan Development B.V., Total EP Kazakhstan and CNPC.

### Natural Gas

Kazakhstan's largest petroleum liquids fields also contain substantial volumes of natural gas, most of which is reinjected into oil wells to improve recovery rates.

Kazakhstan's proven natural gas reserves were at 85 trillion cubic feet (Tcf) as of January 1, 2014. The country's two largest petroleum liquids fields, Karachaganak and Tengiz, are also the two largest natural gas fields.

As Kazakhstan's natural gas production is significantly more than their natural gas consumption, the country has taken advantage of their ability to be a net exporter. Overall, Kazakhstan exported a net total of 4.7 bcm of pipeline natural gas in 2014.<sup>97</sup>

### Coal

In 2012, coal accounted for 63% of Kazakhstan's total energy consumption. Kazakhstan had 37,038 million short tons (MMst) of total

recoverable coal reserves in 2011. Kazakhstan is one of the top ten countries in the world in terms of coal reserves, coal production, and coal exports. Kazakhstan is also 12<sup>th</sup> in the world in terms of coal consumption. Yet, despite being among the top coal countries, Kazakhstan is a relatively small contributor to global coal volumes.

About a quarter of Kazakhstan's coal production is exported, with the majority transported to Russia. Kazakhstan's coal exports and most of its production consist of steam coal, suitable for burning in electric power plants or in other applications to generate steam and heat.

Coal is the major energy source for the country's mining, smelting industries and electricity sector.<sup>98</sup>

Kazakhstan also produces smaller quantities of metallurgical coal which is consumed domestically.



Figure 23 Oil and Gas Map Source: Norway Energy

<sup>96</sup>[http://www.rigzone.com/news/oil\\_gas/a/147490/kazakhstan\\_giant\\_kashagan\\_oil\\_field\\_begins\\_commercial\\_output](http://www.rigzone.com/news/oil_gas/a/147490/kazakhstan_giant_kashagan_oil_field_begins_commercial_output)

<sup>97</sup><http://www.worldenergy.org/data/resources/country/kazakhstan/gas/>

<sup>98</sup> [http://factsanddetails.com/central-asia/Kazakhstan/sub8\\_4e/entry-4674.html](http://factsanddetails.com/central-asia/Kazakhstan/sub8_4e/entry-4674.html)

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## PROJECTS

- Fluor Corporation has announced that its joint venture, KPJV, has been awarded a front-end engineering and design (FEED) contract by Tengizchevroil (TCO) for the Multi-Phase Pump Project in Kazakhstan. Under the contract, KPJV will implement multi-phase pump technology across the gathering network of existing oil and gas facilities at the Tengiz and Korolev fields.
- Canadian company Condor Petroleum has announced that commercial oil production has begun at the Taskuduk and Shoba oilfields.
- Wood Group has secured a contract valued at approximately \$700m to provide services for Tengizchevroil's Future Growth Project-Wellhead Pressure Management project at the Tengiz field. The company will also provide main automation contractor (MAC) services for the project.
- The Tengiz Future Growth Project (FGP) -Wellhead Pressure Management Project (WPMP) - is an integrated project being developed primarily to increase the production capacity from the Tengiz oil field and the adjacent Korolev field. The project is owned and developed by the Tengizchevroil (TCO) a joint venture (JV), consisting of Chevron (50%), ExxonMobil (25%), KazMunayGas (20%) and LukArco (5%). The preconstruction works for the project started in 2013, the front-end engineering design (FEED) study was completed in 2014, the final investment decision (FID) was taken in July 2016, and production is anticipated to begin in 2022.<sup>99</sup>

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<sup>99</sup> <http://www.hydrocarbons-technology.com/news/newsfluor-joint-venture-team-receives-feed-contract-in-kazakhstan-5735094/>

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## GOVERNMENT REGULATIONS AND POLICIES

Kazakhstan has strict Local Content Rules (LCR) under its Subsoil Use Law for IOCs to procure goods, works and services. However, the country also offers incentives to IOCs to hire locals such as interest free loans and advanced payments. Businesses must meet a 90% local workforce for technical personnel. The government also wants 70% Kazakhstanis hired into managerial and executive ranks of foreign enterprises. There are exemptions to the rules. Companies would need to negotiate the LCR in their contracts.

Even though Kazakhstan has LCRs, demand for skilled labor generally exceeds local supply. Kazakhstan has an educated workforce, but the proportion of highly technically competent workers is fairly small. Technical skills, management expertise, and marketing skills are all in short supply. Many large investors rely on foreign workers and engineers to fill the void.

Local content regulations require a minimum of 1% of a project budget be earmarked for training programs and workforce development, including overseas assignments with the lead operator.<sup>100</sup>

LCR also applies to good and services. Local Content in public procurement must be a minimum of 20% for goods and 15% for services. In private procurement, Local Content must meet 82.5% for services and 11% for goods. Subsoil users must file quarterly and annual reports to the KRA Register (Kazakhstan Contract Agency).<sup>101</sup>

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<sup>100</sup> <https://www.export.gov/article?id=Kazakhstan-Labor>

<sup>101</sup> <http://www.glcouncil.org/wp-content/uploads/2015/04/Five-Local-Content-Facts-From-Around-the-World.pdf>

Contracts that fail to meet specified requirements for local materials and labour can be unilaterally terminated by the government, although no such terminations are known to have occurred. The Subsoil Use Law also establishes the government's right to preempt any sale of oil and gas assets, which has occurred.

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## **CERTIFICATION AND STANDARDS**

Firms working through the supply chain in Kazakhstan should have an international certification, such as ISO, API, or ASME, (many local firms and workers do not).

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### **MAJOR COMPANIES**

KazMunaiGas (KMG)

Tengiz, Karachaganak, CNPC-Aktobemunaigas, Uzenmunaigas, Mangistaumunaigas, Kumkol; North Caspian Operating Company (NCOC) Agip Caspian Sea B.V., KMG Kashagan B.V., ExxonMobil Kazakhstan Inc., Inpex North Caspian Sea Ltd., Shell Kazakhstan Development B.V., Total EP Kazakhstan Parsons, Fleur, Daniel (PFD), Schlumberger, Halliburton

Canadian Company: Condor Petroleum

Full list of Companies:  
[http://www.academia.edu/4693805/Companies\\_Working\\_in\\_the\\_Oil\\_and\\_Gas\\_Industry\\_of\\_Kazakhstan](http://www.academia.edu/4693805/Companies_Working_in_the_Oil_and_Gas_Industry_of_Kazakhstan)

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## **WORKING IN KAZAKSTAN**

The most effective means of entering the Kazakhstan market is to establish local presence or to find a local partner or distributor. It is also recommended to sell to a current supplier rather than directly to an energy firm.

A good partner needs to be responsible for handling customs clearance, dealing with established wholesalers/retailers, marketing the product directly to major corporations or the government, and handling after-sales service.

Nova Scotia companies that have experience working Eastern Europe, Ukraine or Russia may have a better experience exporting to Kazakhstan than those not used to the business culture. Companies must also be willing to invest time and money. Entering this market is a long term commitment.

Market Strengths:

- Stable economy
- Easy to start a business
- Strong regulatory environment for companies
- Developing a transparent and effective business culture
- Tax and other preferences for investors

Market Challenges:

- Importers are affected by poorly planned implementation customs codes and unclear documentation requirements
- Competition is strong from Russia and China. Investment from China remains high while inexpensive products from China and Russia are readily supplied across the borders
- Interpretation of laws by local officials is often at variance with that of the central government, especially in the



implementation of Kazakhstan's system of taxation, and collection of revenues

- Corruption remains widespread despite the government's anti-corruption campaigns

Foreign workers to Kazakhstan must obtain work permits, a practice which can be difficult and expensive. In 2015 Kazakhstan introduced amendments to the migration and employment law that went into effect January 1, 2017.

For more information:

<http://kazembassy.ca/visa-and-consular-information/obtaining-a-visa-to-kazakhstan/>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

World Energy City Partnership member city, Atyrau, is the energy capital of Kazakhstan.

The national oil and gas company, KazMunaiGas (KMG), is responsible for tendering. The company also plays a role in practically all contracts with foreign oil and gas companies.

Reportedly, the offshore development program will call for more new offshore blocks to eventually be privatized through open tenders. The new exploration will present an opportunity for logistics and pipeline projects.

Equipment providers may want to sell through an existing supplier. About 80% of the equipment used in the oil and gas sector and the mining industry is imported; most of it manufactured in Russia and China.

Best Prospects:

- Research and data management
- Laboratory studies
- Oil spill cleanup technologies
- Pipeline services

- Seismic processing and interpretation
- Petroleum software development
- Sulfur removal & disposal technologies
- Well stimulation & field abandonment services
- Underwater repair equipment
- Downstream engineering services

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

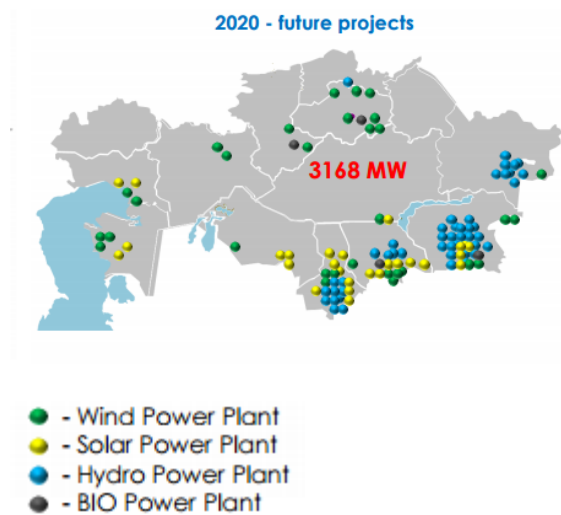
Kazakhstan's economic growth slowed due to the fall in oil price and demand for global oil, and production setbacks at Kashagan.

Kazakhstan's economy grew by 1.2% in 2015 and is forecast to grow by about the same in 2017.

## **RENEWABLE INDUSTRY**

Kazakhstan has huge renewable energy potential, particularly for hydropower, solar and wind. This sector is almost entirely untapped as renewables currently only constitute about 1% of Kazakhstan's energy balance. Until recently, the renewable energy industry in Kazakhstan was derived solely from hydropower plants.

The target in the government's action plan is for renewable energy to meet 3% of the total demand by 2020 and 25% by 2050. Approximately 48 projects on renewable energy production have been launched in the country to date, with plans to implement more than 100 projects by 2020. The government has currently committed to building 13 wind plants, 14-15 hydropower plants and four solar stations. The largest solar power station is in the Kyzylorda Province and will be capable of generating 65 megawatt hours of electricity a year (US\$93 million).



**Figure 24 Renewable Energy Projects Source: Government of Kazakhstan, Action Plan 2013-2020**

A key challenge to Kazakhstan’s energy sector is the upgrade of its aging infrastructure. At present, amortization of electric plants is about 70 percent. The average age of thermal plants is almost 30 years, and hydro plants are more than 36 years.

Barriers to developing renewable energies in Kazakhstan include: limited availability of long-term financing; lack of risk mitigation measures in the newly established renewable market; limited experience and capacities in project planning and management; and uncertainties of the current regulatory framework.

### Wind Power

About 50% of Kazakhstan’s territory has an estimated average wind speed of about 4-5 m/s with overall wind potential estimated at around 18,000 GWh per year.

The country has one onshore wind farm, Ereymentau, with 22 turbines, nominal power

45,100 kW. The developer is Samruk-Energy JSC and it is owned by Wind parks of Ukraine LLC.<sup>102</sup>

Samruk-Energy JSC was recently awarded a \$94 million loan from the Eurasian Development Bank to build Kazakhstan’s largest wind farm. The project will produce 172 million kilowatt/hours of electrical energy per year. The government estimates that this farm will save more than 60 million tons of coal used, and greatly reduce the country’s green house gas emissions.<sup>103</sup>

Also announced, First Wind Power Station and the European Bank for Reconstruction and Development are teaming up to build the country’s first commercial wind farm in Yereimentau in Akmola Province (\$94 million, generating 45 megawatts).<sup>104</sup>

Companies working in Kazakhstan renewable energy:

- Central Asia Green Power BV
- KazWindEnergy
- Samal Energy
- Institute Kazselenergoeroekt
- Caspian Gel
- Aksu HPP
- CUBE Engineering GmbH
- IHP-UK
- GETI GmbH
- Ecoenergy.kz
- Promondis Kazakhstan
- Datang-TT-Energy
- Energy, Ecology, Engineering

Full list: <http://renergy.kz/ru/about/partners>

<sup>102</sup>[http://www.thewindpower.net/windfarm\\_en\\_21314\\_ereymantau.php](http://www.thewindpower.net/windfarm_en_21314_ereymantau.php)

<sup>103</sup> <http://kzgreenenergy.com/wind-energy/>

<sup>104</sup> <http://kzgreenenergy.com/green-energy-projects-in-progress/>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Best Prospects:

- Project management services
- Consultancy services in green energy, waste management, energy efficiency
- Engineering and construction services for onshore wind

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

In 2009, Kazakhstan adapted a law “On Support of Renewable Energy”. This step was designed to assist the country’s plan to reach a goal of having 3% of total energy from renewables by 2020. According to Kazakhstan’s plans, the share of renewable energy will reach 25% by 2050.

In 2015, the country signed an enhanced partnership agreement with the EU to cooperate in joint work to improve the legislative framework in renewable energy. Then in May 2016, the government announced plans to use special auctions to purchase renewable energy from energy-producing companies. The auctions are proposed to make the selection process for projects and investors transparent and clear, increasing the effectiveness of technologies and minimizing influence on tariffs.<sup>105</sup>

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## **FUNDING INCENTIVES**

A number of projects, including wind and solar power plants, have been supported by the European Bank for Reconstruction Development (EBRD)<sup>106</sup> and the Climate Investment Funds through its Climate Technology Fund (CTF). Notably, the interventions by the EBRD and the

CTF were explicitly designed to facilitate private sector participation in project development and mitigate associated risks.

Climate Investment Fund

<https://www-cif.climateinvestmentfunds.org/news/prize-bank%E2%80%99s-pioneering-renewables-work-kazakhstan>

The World Bank also funds projects in Kazakhstan. Nova Scotia companies should review proposed and funded projects.

<http://www.worldbank.org/en/country/kazakhstan/projects>

Nova Scotia companies should also contact their Global Affairs Canada representative for assistance with working with international financial institutions (IFI’s).

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## **OTHER SOURCES OF INFORMATION**

Canadian Trade Commissioner Service

<http://tradecommissioner.gc.ca/kazakhstan/index.aspx?lang=eng>

US Commercial Service

<https://www.export.gov/article?id=Kazakhstan-Market-Overview>

US Government EIA Country Analysis Brief – Kazakhstan

<https://www.eia.gov/beta/international/analysis.cfm?iso=KAZ>

Republic of Kazakhstan Country Economic Memorandum Getting Competitive, Staying Competitive: The Challenge of Managing Kazakhstan’s Oil Boom\* Background Paper No. 5: The Supplier Development in the Oil and Gas Sector of Kazakhstan April 2004

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<sup>105</sup> <http://astanatimes.com/2016/05/res/>

<sup>106</sup> <http://www.ebrd.com>

[http://siteresources.worldbank.org/INTKAZAKHS/TAN/Resources/Backgroundpaper5\\_SupplierDevelopment\\_April2004.pdf](http://siteresources.worldbank.org/INTKAZAKHS/TAN/Resources/Backgroundpaper5_SupplierDevelopment_April2004.pdf)

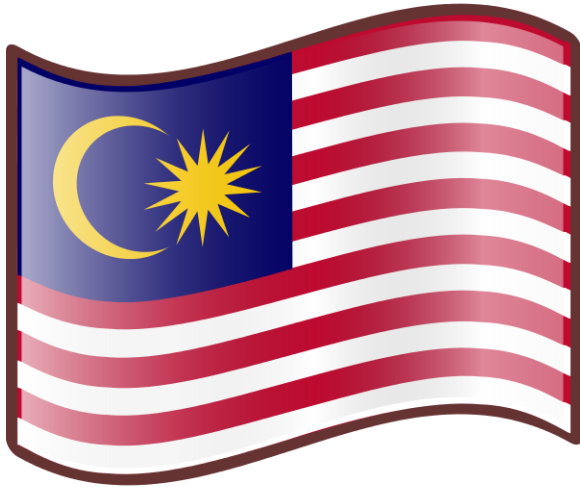
Association of Renewable Energy Kazakhstan  
<http://futureenergyforum.org/assets/future-energy/pdf/3/Arman%20Kashkinbekov%20Report.pdf>

GREEN ACTION PROGRAMME OCED, Financing Climate Action in Kazakhstan GREEN ACTION PROGRAMME COUNTRY STUDY, 2016

UK Department of International Trade  
<https://www.gov.uk/government/publications/exporting-to-kazakhstan/exporting-to-kazakhstan>

**NOTES:**

# MALAYSIA



## MALAYSIA COUNTRY PROFILE

### OVERVIEW

Malaysia is one of the strongest economies in Southeast Asia, ranking behind Indonesia, Thailand and Singapore. Malaysia's economic strength has been largely due to the oil and gas sector which makes up about 20% of the total gross domestic product. Malaysia has the world's 14<sup>th</sup> largest natural gas reserves and the 23<sup>rd</sup> largest oil reserves in the world.

The country is a global location for offshore manufacturing and service based operations. Multinational corporations from more than 40 countries have invested in over 3,500 Malaysian companies. In the past, Canada had a strong presence in Malaysia with the former Talisman Energy.

Country Facts	
Nominal GDP	296.28 Billion USD
Population	30.33 Million
Total Trade/GDP	134.15%
Currency	Malaysian Ringgit (MYR)
Merchandise Imports from Canada	790.05 Million CAD
Canadian direct investment	666 Million CAD
Main imports	Machinery & Equipment, Manufactured Goods, Mineral Fuels, Chemicals

Figure 25 Source: EDC

Malaysia also plans to grow its renewable energy industry in the nuclear, solar and hydro sectors. The population of the country is over 30 million, and the government needs to manage the energy consumption demands from its growing population.

Malaysia is a member of the Association of Southeast Asian Nations (ASEAN). This is a regional organization formed to promote intergovernmental cooperation and facilitates economic integration amongst its members - Indonesia, Malaysia, the Philippines, Singapore, Thailand, Brunei, Cambodia, Laos, Myanmar (Burma), and Vietnam.

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## COUNTRY SOURCES OF ENERGY

The primary energy resources consumed in Malaysia are petroleum and natural gas, with estimated shares of 40% and 36%, respectively in 2012. About 17% of the country's energy consumption is met by coal.

Approximately 7% of the country's energy mix is from renewable resources. Within this percentage, the Sustainable Energy Development Authority (SEDA) reported in 2016, that this figure was comprised of 68% solar PV, 17% biomass, 5% mini-hydro, 4% solid waste, and 2% biogas.

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## CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

At the beginning of 2015, liquids reserves (oil and condensate) were estimated to be over 2.5 billion barrels while remaining gas reserves were estimated to be nearly 34 trillion cubic feet. Malaysia expects offshore oil and gas production to equal onshore production in the next 15 to 20 years.

The country has targeted 2017 to become Asia Pacific's oil and gas hub. Malaysia aims to take full advantage of its strategic location for key shipping lanes of petroleum in the region.

Moreover, through pro-business policies, the country is committed to ensuring it has a sustainable and successful oil and gas industry. Malaysia created a vibrant market for merger-and-acquisition activities to acquire new technology, more capabilities, physical space and training workers to support the growth of the upstream and downstream industry sector.<sup>107</sup>

Malaysia's heavy reliance on oil and natural gas to sustain its economic growth is causing the

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<sup>107</sup> <http://www.mida.gov.my/home/oil-and-gas/posts/>

government to emphasize fuel diversification through coal imports and to promote investments in renewable energy.

Malaysia's developed a strategy for renewable energy, the 11<sup>th</sup> Malaysia Plan (11MP). The strategy sets a target of 2080 MW of renewable energy capacity by 2020. The energy mix proposed will be comprised of 38% biomass, 17% solid waste, 12% biogas, 24% mini-hydro, and 9% solar photovoltaic (PV). New projects and technologies are also being investigated.<sup>108</sup>

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## ENERGY INDUSTRY

### OIL AND GAS

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As one of the major oil and gas producers in Southeast Asia, all oil and gas rights in the country are held by the national oil and gas company, Petroliaam Nasional Berhad (PETRONAS). PETRONAS is the sole owner of mineral rights and has overall responsibility and oversight for all aspects of the petroleum operations in Malaysia, including licensing.

More than half of Malaysian oil production currently comes from the Tapis Oil Field in the offshore Malay basin. Recently, Malaysia saw marginal growth in oil production and reserves, while gas production continued to slip downwards. This continuing decline in production at Malaysia's major shallow water producing oil fields prompted government to encourage investment in an Enhanced Oil Recovery (EOR) program and the development of marginal and deep water reserves. Malaysia's new reserves are found mostly off the coast of Northern Borneo between 200 to 1200 metres

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<sup>108</sup> <https://www.oxfordbusinessgroup.com/analysis/refresh-and-renew-government-policy-and-market-forces-are-driving-growth-throughout-renewables>

deep, making it more costly to extract these resources.

Malaysia is also actively investing in reservoir development. Exploration and development activities in Malaysia focus on offshore the Sarawak and Sabah fields.

The country's strategy for energy security is to export its premium Tapis sweet crude oil and import low-grade oil to refine in its downstream facilities. The country plans to increase its refining capacity to become a net oil product exporter. The Pengerang Integrated Petroleum Complex (PIPC) in Johor, and Sipitang Oil & Gas Industrial Park (SOGIP) in Sabah will almost double the refining capacity nationwide from 588,000 bbl/d to 1,158,000 bbl/day. Malaysia has invested heavily in refining activities and now has nearly 539,000 barrels per day (bbl/d) of refining capacity at seven facilities, fulfilling most of its demand for petroleum products domestically. Facilities are operated by PETRONAS, ConocoPhillips, and Petron. The Pengerang Johor Refinery Project at the southern tip of Peninsular Malaysia is anticipated to be completed in 2019.

To support the needs of the supply value chain, there are over 3,500 oil and gas businesses in Malaysia. The industry is comprised of international oil companies, independents, services and manufacturing companies. Key strategic segments for the industry are in marine, drilling, engineering, fabrication, offshore installation and operations, and maintenance (O&M). Many major global machinery & equipment manufacturers have bases in Malaysia, not only for the Malaysian oil and gas industry, but to serve other markets as well.

## **LNG**

In 2013, Malaysia was the world's second-largest exporter of liquefied natural gas after Qatar. Malaysia held 83 trillion cubic feet (Tcf) of proved natural gas reserves as of January 2014, and it was the third-largest natural gas reserve holder in the Asia-Pacific region. More than half of the country's natural gas reserves are located in its eastern areas, predominantly offshore Sarawak. Most of Malaysia's gas reserves are associated with oil basins, although Sarawak and Sabah have an increasing amount of non-associated gas reserves. These reserves have offset some of the declines from mature oil and gas basins offshore.

The country is currently experiencing a geographic disparity of natural gas supply and demand amongst its regions. The Western Peninsular Malaysia demands more natural gas to fuel the power and industrial sectors, while the eastern states of Sarawak and Sabah, produce natural gas and currently lack the local demand for it. To meet pressing gas needs in Peninsular Malaysia, PETRONAS is developing various degasification terminals to secure supply from the global gas market.

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## **PROJECTS**

- In January 2017, Malaysian oilfield solutions provider, SapuraKencana Petroleum, received five contracts worth a combined US\$300m for engineering, construction and installation services to provide underwater services for Petronas Carigali. The contract also includes analysis, maintenance and repair services for Petronas Carigali's subsea facilities located offshore Peninsular Malaysia. Work is expected to start in April 2017.
- SapuraKencana Energy has made a significant gas discovery from its 2015 three-well drilling campaign in offshore

Malaysia. All three wells are located within the Block SK408 production sharing contract (PSC) area and targeted non-associated gas within the primary target Late Miocene Carbonate reservoirs.

- In December 2016 Shell announced that it has started oil production from the Malikai Tension-Leg Platform (TLP), which is located 100km off the coast of Sabah, Malaysia. Shell operates the Malikai project with 35% interest. Other partners are ConocoPhillips Sabah (35%) and Petronas Carigali (30%).
- Barakah Offshore Petroleum subsidiary PBJV Group has secured a contract from PETRONAS in 2016 to work on its Floating LNG1 (FLNG) in offshore Malaysia. Under the contract, PBJV will provide engineering, procurement, installation and related activities for FLNG offshore works.
- Lundin Malaysia has signed farm-out agreements with Dutch company DYAS's subsidiaries for part of its working interests across three production sharing contracts (PSC) in Malaysia. The agreements will cover Blocks PM328, SB307/308 and gas holding areas in SB303.



**Figure 26 Oil and Gas Map Source: Vestigo Petroleum**

## GOVERNMENT REGULATIONS AND POLICIES

Contractors are required to source oil and gas equipment, supplies and services from suppliers registered with PETRONAS. Also, companies that only wish to participate in tenders and activities in the downstream sector are required to register with PETRONAS before so doing. To support the process, PETRONAS now has an e-bid system for suppliers to submit offers.

In order for a company to qualify for a PETRONAS license or registration, the company must be registered as either a private or public incorporated company or be part of a professional body related to Land Surveying, Quantity Surveying, Architecture or such similar.

Contractors are encouraged to hire Malaysian nationals (Burniptra) at all management and employee levels. The minimum Bumiputera participation percentage varies between the scope of the project and it also depends on the mode of operation. Scopes of work are defined in the PETRONAS' Standardized Work & Equipment Categories (SWEC) which covers the product and service requirements of both the upstream and downstream sectors.

Foreign companies can also participate in tenders and work in the upstream sector of the oil and gas industry in Malaysia by appointing a local company as an exclusive agent representative. Appointed agents must hold a valid PETRONAS License/Registration. Alternatively, a foreign company can form a new Joint Venture (JV) company with a local company/individual. The JV company must also submit for its License/Registration application to PETRONAS and comply with the regulations accordingly.



Please review guidelines at:  
<http://www.petronas.com.my/partnering-us/licensing-registration/Documents/30NOV2015%20ENGLISH%20PANDUAN%20AM.pdf>

The Malaysian government offers tax incentives to offset LCR policies. Companies, which are placed by the government as high priority, are eligible for a five year partial exemption from paying income tax, and companies that have Multimedia Super Corridor status (a government scheme design to grow high technology and research activities) would have tax and regulatory exemptions.<sup>109</sup>

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## CERTIFICATION AND STANDARDS

PETRONAS maintains very high Health Safety and Environment (HSE) standards, and as such it holds contractors and suppliers responsible to operate at no less than its minimum HSE guidelines.

Equipment used in Malaysia also has to meet the international standards of organizations such as the American National standards Institute (ANSI), the American Petroleum Institute (API) or BSI British standards. PSC contractors and foreign JV partners should ensure that their leasing or purchase contracts specify which standards apply, in order to ensure that equipment is compliant and meets insurance requirements.

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## WORKING IN MALAYSIA

The most effective means for Nova Scotia companies entering the Malaysian market is to establish local presence or to find a local partner or distributor.

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<sup>109</sup> <http://www.glcouncil.org/wp-content/uploads/2015/04/Five-Local-Content-Facts-From-Around-the-World.pdf>

Market Strengths:

- English speaking, educated workforce
- Close to major Asia Pacific economies
- Excellent infrastructure and transport connectivity
- Well developed financial sector

Market Challenges:

- Public procurement process not transparent
- Ranked in top third of countries in corruption perceptions index
- A weak competitive environment (including policies that favour Bumiputera, the indigenous Malaysians)
- Risks of kidnapping and violence in some areas

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### MAJOR COMPANIES

PETRONAS

PSC Contractors

MISC, M3nergy, Bumi Armada, Tanjung Offshore, SBM Offshore, Modec, Bluewater, Aker Floating Solution, BW Offshore, MMHE, Ramunia, Boustead, Sime, Kencana, Oilfab, Keppel, CNOOC, SembCorp, J.Ray McDermott, Hyundai, SHI, SapuraCrest, Petra Perdana, Alam Maritim, Jasa Merin, Sealink, CH Offshore, Swiber, Ezion, Ezra, Great Offshore, Jaya, Mermaid Maritime, Otto Marine Aberdeen Asset Management, Allied Pickfords, BAE Systems, BP, BAT, Debenhams, Dyson, Pinewood Studios, Shell, Tesco and Weir Group.

Canadian companies with offices in Malaysia: Tamarind Energy, Petra Petroleum Corp, SNC Lavalin

For a listing of local companies:  
<http://www.malaysianqas.com/portal/>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

World Energy City Partnership member, Kuala Lumpur, is fast emerging as the leading energy city of the Asia-Pacific region.

Opportunities in Malaysia remain in the mature shallower-water areas for smaller players, both domestic and foreign contractors and suppliers.

Larger companies are shifting their exploration in to the deepwater Sarawak and Sabah basins. Opportunities exist for companies that can consistently deliver cost effective new technology that reduces development and/or provides increased production performance.

The PETRONAS University of Technology has a goal of becoming the region's foremost school for the oil and gas industry science and technology research and application. Companies providing education and research in HSE and ICT may also be able provide education and training.

Best Prospects:

- Deep water drilling technology
- Enhanced Oil Recovery (EOR) technology
- Oil Field Services and Equipment (OFSE) operations
- Energy efficiency technology
- LNG education and training
- Safety training and other niche offshore education

In Canada, the Pacific NorthWest LNG is a proposed natural gas liquefaction and export facility in British Columbia. The facility would liquefy and export natural gas produced by Progress Energy Canada Ltd. in northeast B.C. Both Pacific NorthWest LNG and Progress Energy are majority-owned by Malaysia's PETRONAS. The Government of Canada

approved its environment assessment in September 2016; however the project is waiting for the shareholders final investment decision<sup>110</sup>

Nova Scotia companies could leverage this relationship to work with PETRONAS and its suppliers.

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

The significant decline in oil prices forced the Malaysian oil and gas industry to review existing and new projects. PETRONAS reduced a sizable portion of its capital and operational expenditures planned for 2016. They are also prioritizing their upstream activities with a focus on the continuation of its deep-water exploration and production (E&P) activities and brownfield rejuvenation.

PETRONAS introduced the Cost Reduction Alliance (CORAL) 2.0 and has engaged 25 petroleum contractors to collectively negotiate supply and service contracts to realize genuine cost savings.<sup>111</sup>

## **RENEWABLE INDUSTRY**

There is an increasing trend in Malaysia to adopt greener and more efficient technology for a more sustainable energy generation and a cleaner environment. The lead government department in Malaysia is the Sustainable Energy Development Authority (SEDA).

For the period Jan – Dec 2015, a total of 128 projects in renewable energy with total investments of RM1.37 billion were approved of

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<sup>110</sup> <http://www.pacificnorthwestlng.com/the-project/the-project/>

<sup>111</sup> <https://www.export.gov/apex/article2?id=Malaysia-Oil-and-Gas-Equipment>

in the area of RM1.35 billion. The country created their strategy for renewable energy in the 11<sup>th</sup> Malaysia National Development Plan. The country is incorporating a feed-in-tariff mechanism to make renewable energy competitive with conventional energy sources. The country is focusing on developing:

- Electric vehicle components
- Solar PV modules and balance of system
- LED and OLED
- Biomass fuel/power using indigenous feedstock
- Methane capture and biogas power plants

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Best Prospects:

- Technologies, partnerships and research co-operation in industrial waste recycling and wastewater treatment systems
- LED lights

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

SEDA is implementing policies to guarantee access to the grid for producers of biomass, biogas, solar and mini-hydro. SEDA will issue approval certificates to generators for projects up to 30 MW in size. These generators will then sell their output to distributors – Tenaga Nasional Bhd (TNB) and NUR Power on the peninsula, and Sabah Electricity Sdn Bhd (SESB) in eastern Malaysia.

There is also a cap on the number of approved certificates. They will be issued every six months for each power type. This process will ensure

funds are available to make all the payments to suppliers.

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## **FUNDING INCENTIVS**

The High Commission of Canada in Malaysia administers an annual fund, the Canada Fund for Local Initiatives (CFLI). The program funds small, but visible high impact, results-oriented projects that are proposed and implemented by local NGOs and other grassroots organizations.

The average contribution is in the range of CAD \$15,000-\$35,000 for each individual project. Larger projects may be considered on an exceptional basis, with appropriate justification for use of funds (to a maximum of \$50,000).

Proposals are now closed. Please check with Global Affairs Canada (GAC) for next the round of funding and working with a local partner.

[http://www.canadainternational.gc.ca/malaysia-malaisie/offices-bureaux/CFLI\\_FCIL.aspx?lang=eng](http://www.canadainternational.gc.ca/malaysia-malaisie/offices-bureaux/CFLI_FCIL.aspx?lang=eng)

Malaysia has incentives for renewable energy projects however; the applicant/project must be located in Malaysia and the company 70% owned by a Malaysian. <https://www.gtfs.my/>

The Asia Development Bank (ADB) is not active in Malaysia, as its projects, whether public or private, must satisfy the criterion of poverty alleviation in order to qualify for ADB financing.

The Trans-Pacific Partnership (TPP) Free trade deal has now been cancelled since the US government announced they are pulling out of the deal. TPP can only be ratified if six countries, totaling 85% of the deal's combined GDP, approve the deal. Only the United States and Japan had the sole power to veto the TPP because of the size of their economies.

Funding is an issue right now in Malaysia. There is currently an alleged multibillion-dollar misappropriation of money in the Malaysian state investment fund for economic development. To date, four people have been sent to prison, and the Malaysian Prime Minister is under investigation.

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## **OTHER SOURCES OF INFORMATION**

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US Government EIA Country Analysis Brief – Malaysia

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Oil & Gas Sector Profile Malaysia, October 2015

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## **NOTES:**

# MEXICO



## MEXICO COUNTRY PROFILE

### OVERVIEW

Mexico is the world's 15<sup>th</sup> largest economy and is one of the largest producers of petroleum and other liquids. Mexico is also the 4<sup>th</sup> largest oil and gas producer in the Americas after the United States, Canada, and Brazil. Oil is a crucial component of Mexico's economy and earnings from the oil industry accounted for about 32% of total government revenues in 2015.

Nonetheless, Mexico's oil production has steadily decreased since 2005 as a result of natural production declines from the Cantarell and other large offshore fields. In August 2014, the government brought in energy reforms to address the declines of its domestic oil production. The most important was the ending

### Country Facts

Nominal GDP	1,143.70 Billion USD
Population	127.02 Million
Total Trade/GDP	72.75%
Currency	Mexican Peso (MXN)
Merchandise Imports from Canada	6,591.95 Million CAD
Canadian direct investment	14,816 Million CAD
Main imports	Intermediate, Capital and Consumer Goods

Figure 27 Source: EDC

of the 75-year monopoly of state owned oil company, Petroleós Mexicanos (PEMEX). The reforms also included objectives to develop power generation projects with clean energy.

### COUNTRY SOURCES OF ENERGY

Mexico's total energy consumption in 2015 consisted mostly of petroleum at 46%, followed by natural gas and diesel. The country generated an estimated 310 billion kilowatthours (kWh) of electric power in 2015, an increase of 21% from a decade ago. Power plants using fossil fuels generated 80% of Mexico's electricity.

At the end of 2015, Mexico was importing 54% gasoline, 29% diesel, 35% jet fuel and 33% of its natural gas needs.

All other fuel types contribute relatively small amounts to Mexico's overall energy mix.

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

Downstream, Mexico's total oil consumption remained relatively steady over the past decade, averaging about 1.7 million b/d in 2015. However, natural gas is increasingly replacing oil as a feedstock in power generation. Projected increases in natural gas consumption are resulting in plans to build new pipelines to import natural gas from the United States and invest in Mexico's power plants.

Also, a result of the energy reform, investment in Mexico's renewable energy sector is expected to increase sharply in the following 15 years. The Development Program of the National Electric System (PRODESEN) for 2016-2030 has committed 1,684 million pesos (approximately US\$90 million) out of which 79% will be invested in generation from clean energy sources. The largest share will be for wind and solar projects, representing 23% and 20% respectively.

The country is also becoming more attractive for foreign direction investment. The renewable industry recently received US\$13.5 billion from the US, Germany and Spain. The Canadian government (NRCan) announced in 2016 that it will contribute CDN\$14 million to reduce short-lived climate pollutants (SLCPs), like methane, through partnerships with Mexico and Chile.<sup>112</sup>

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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Mexico had 9.7 billion barrels of proved oil reserves as of the end of 2015, consisting mostly of heavy crude oil varieties. The largest concentration is from the offshore southern part

of the country, particularly the Campeche Basin. Because the concentration of Mexico's oil production is offshore, tropical storms or hurricanes often disrupt oil operations.

There are also sizable reserves in the onshore basins of the northern parts of Mexico. Onshore fields account for roughly 25% of Mexico's total crude oil production. Most of this production is of light or extra-light crude oil from the southern part of the country. The largest oilfield in the south of Mexico is Samaria-Luna, which produced nearly 145,000 b/d in 2015. The most notable onshore prospect in the north is the Aceite Terciario del Golfo (ATG) project, better known as Chicontepec, located northeast of Mexico City.

As previously noted, Mexico's oil production has been in decline. The country's production is down approximately 32% from its peak in 2004. Crude oil accounted for 2.3 million b/d of total output, with the remainder attributed to lease condensate, natural gas liquids, and refinery processing. Mexico is a significant crude oil exporter as well as a net importer of refined petroleum products.

Mexico's six refineries, all operated by PEMEX, had a total refining capacity of 1.54 million b/d as of the end of 2015. Mexico hopes to reduce its imports of refined products from the United States by improving domestic refining capacity and the output quality. In February 2012, PEMEX awarded a contract for the design of a new refinery at Tula, but in December 2014 the company cancelled this contract and opted for a US\$4.6 billion expansion of the existing facility. Gasoline and diesel production is estimated to increase from 140,000 b/d to 300,000 b/d at Tula when it is completed in 2018.

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<sup>112</sup> <http://www.newswire.ca/news-releases/canada-invests-in-clean-technology-in-mexico-and-in-chile-to-reduce-pollution-for-a-cleaner-world-601133406.html>

Working with PEMEX may not run smoothly. The company is nearly US\$90 billion in debt and owes more than US\$5.5 billion to service providers. In April 2016, the Mexican government gave PEMEX a US\$1.5 billion tax break, plus another US\$4.2 billion, to help pay contractors. In return for the aid, PEMEX must slash its debt by the same amount, stick to an austerity strategy, and develop debt management plans. PEMEX also received a US\$822 million credit line from a consortium of private Mexican banks, which can be put toward debt repayments.<sup>113</sup>

Canadian companies have done considerable business in the past with PEMEX. Export Development Canada support can also be leveraged for working in Mexico. As reported by the Canadian Manufacturers and Exporters (CME Doing Business in Mexico), PEMEX had previously acquired equipment and supplies from at least 111 Canadian firms on an annual basis, and purchases from these companies rose from US\$69 million in 2006 to US\$613 million in 2009. Canadian firms have invested extensively in Mexico in order to service the oil and gas market more effectively, and several Canadian drilling companies established offices in the country in 2009 and 2010. Nova Scotia companies may be able to capitalize on Mexico's new openness to foreign companies.

## LNG

Mexico has considerable natural gas resources, but its production is modest relative to other North American countries. Natural gas used for electricity generation has risen rapidly as price and availability have made it a more economic fuel source. The country currently imports most of its gas from the United States. Until a

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<sup>113</sup> <http://policyoptions.irpp.org/magazines/november-2016/mexicos-oil-market-challenges-and-canada/>

pipeline is constructed, it is cost prohibitive for Canada to export gas to Mexico.

## Coal

Coal consumption in Mexico leveled out as natural gas consumption increased. Coal represents only 7% of total electricity generation. Mexico is a net importer of coal, supplying about 80% of its coal demand domestically.

## Nuclear

Mexico has one nuclear power plant, Laguna Verde, in Veracruz. The Laguna Verde power plant includes two boiling water reactors with a combined generating capacity of 1,510 MW. It accounted for 4% of Mexico's total electricity generation in 2015. Current operation licenses for the reactors expire in 2020 and 2025, but they are expected to receive extensions. There are plans to expand Mexico's nuclear generation capacity by building additional plants; three nuclear power plants are planned and scheduled for operation by 2026, 2027, and 2028.

## Shale Gas

Mexico ranks 8<sup>th</sup> in the world in shale oil reserves. The country has 13.1 billion barrels of technically recoverable resources. Shale resources are found in the Burgos basin near the US northern border. The development of the shale gas industry is hindered by required technology and the availability of water resources.

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## PROJECTS

- BHP Billiton has entered a contract with PEMEX to complete development work at Trion offshore discovery. The agreement comprises of a commitment to deliver a minimum work program

which includes drilling of an appraisal well, one exploration well, and additional seismic data acquisition.

- Chevron, Inpex and PEMEX have signed a contract with Mexico's National Hydrocarbons Commission (CNH) for exploration and extraction of hydrocarbons in Block 3 North of the Plegado Perdido Belt in the Gulf of Mexico.
- Murphy Oil has initiated a project to install a multi-phase boosting system to improve recovery at the Dalmatian oil and gas field, located on the DeSoto Canyon. Completion is expected in 2018.
- Robert Gordon University (RGU) has begun working with the Mexican oil and gas industry on behalf of the UK government to build a skills development framework. For decades Mexico's oil and gas industry has been state-run and there have been no new sales of exploration and extraction licenses for 15 years, leaving its sector underdeveloped. Now as Mexico embarks on a new energy phase, the country has looked to the UK's oil and gas industry for advice before opening up previously untapped resources. Thousands more skilled workers will be needed to plan, build and operate new oil and gas projects, and Aberdeen's RGU is in place to advise Mexico's Ministry of Energy on the best training initiatives.

## GOVERNMENT REGULATIONS AND POLICIES

The newly formed National Hydrocarbons Commission (CNH) is in charge with regulating, overseeing, and evaluating all hydrocarbons exploration and production activities in Mexico. With the reorganization of the national energy company PEMEX, new regulation responsibilities were given to the National Hydrocarbon Commission and the Energy Regulatory

Commission. The country also created the Petroleum Environmental Agency (ASEA) to ensure that PEMEX, its contractors, and companies bidding and awarded projects by CNH obtain the proper environmental permits before exploration, drilling, and extraction activities can begin.



**Figure 28 Oil and Gas Map Source: Bentek Energy**

Mexico's regulatory and fiscal terms for upstream projects, according to Article 46 states that extraction activities performed in national territory should achieve, on average, at least 35% LCR. However, requirements can range from 15-35%, depending on the stage of the contract.<sup>114</sup> LCRs may be excluded in deep and ultra-deepwater exploration and extraction, this policy is still under development by the Mexican government.

In 2016, the Ministry of Economy had opted to set a low local content requirement for the deepwater bid round. The new rule, announced in Mexico's official journal of the federation (DOF), says oil and gas companies must use 8% local content in deep and ultra-deep waters by

<sup>114</sup> <http://www.cms-lawnow.com/ealerts/2016/07/mexico-oil-and-gas-licensing-round-2-gets-underway>



2025. This number is up from 3% established in 2015. LCR goals should be set in accordance to the characteristics of the activity.<sup>115</sup> Additionally, PEMEX is required to have a 20% stake in all cross-border fields, including deepwater and onshore shale projects.

On the positive side, Mexico's energy reform will allow international energy companies to operate in Mexico through competitive production sharing contracts and licenses. The reform will also eventually allow greater private investment in retail fuel distribution.

PEMEX remains state-owned, but it is being given more budgetary and administrative autonomy. The company will have to compete for bids with other firms on new projects. However, PEMEX is allowed first refusal on developing Mexican resources before private companies can bid. This phase is known as Round Zero and has resulted in PEMEX being awarded the right to develop 83% of Mexico's proved and probable oil reserves and 21% of total prospective resources.

To sell geological services, CNH is requiring companies to register on its website so that bidding companies can submit a bid with CNH pre-authorization. CNH has created a program called "Authorizations for Recognition and Exploration of Upstream Oil and Gas" (ARES). Some of the companies registered are Dolphin Geophysical, Dowell Schlumberger, Fugro Survey, GX Technology Corporation, and PGS Geophysical and Spectrum.

Next, there are also plenty of opportunities in midstream. The Federal Commission of

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<sup>115</sup><http://www.oedigital.com/component/k2/item/12030-mexico-lowers-local-content-rule-for-deepwater>

Electricity is increasing pipeline infrastructure by releasing public tenders. A particular opportunity lies within a subsea pipeline project for transporting natural gas from Texas to Veracruz, Mexico.

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## **CERTIFICATION AND STANDARDS**

The oil and gas industry's training standards body has set new and higher standards for Tropical Helicopter Underwater Escape Training (THUET). The training has increased from four hours to a one-day course which must be repeated every four years.

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## **WORKING IN MEXICO**

Nova Scotia workers can enter Mexico through the NAFTA agreement. Nova Scotia companies unfamiliar with working in Mexico should consider partnering and working with other Canadian companies who have experience in working the Mexican government system.

Market Strengths:

- Largest economy in Latin America, after Brazil
- Established ties with Canadian companies.
- North American Free Trade Agreement
- Proximity to the market

Market Challenges:

- Highly competitive market from other international suppliers. Products and services need to have a competitive advantage and companies need to be able to market this advantage
- It takes time to build and maintain relationships with clients and distributors
- Language barriers mean that interpreters may be required

- Corruption in police forces and issues with kidnapping
- Staying on top of any upcoming changes to NAFTA

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

World Energy City Partnership member, Villahermosa, is the hub for O&G operations in the South of Mexico.

The Mexico government reports that the country desperately needs technology to boost oil and gas production in fracking and deepwater drilling.<sup>116</sup> Nova Scotia companies that have experience in unconventional resources may have potential in this subsector.

Demand for imported upstream oil and gas equipment and services is expected to increase with the new reforms. These reforms will also spur investment as private companies aim to comply with the schedules on the awards for shallow waters, onshore, deep water, heavy oil and unconventional oil and gas projects.

In the upstream oil and gas subsector, PEMEX as well as large companies like ExxonMobil, BP and Chevron and mid-sized private companies are invited to bid and will be requiring suppliers to register to sell their equipment and services. Selling to these companies will be a market entrance strategy for Nova Scotia companies.

Best Prospects:

- Project consultancy
- Front End Engineering Design (FEED)
- Enhanced / improved oil recovery
- Asset integrity management
- Production operations
- Environmental control

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<sup>116</sup> <http://www.cbc.ca/news/business/mexico-oilandgas-suncor-atco-1.3618771>

- Regional geological studies (including 3D and 2D seismic)
- Reservoir appraisal and exploration techniques
- Training and education
- Deep water technologies
- Develop heavy and extra heavy oil recovery technology

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## **MAJOR COMPANIES**

Petroleos Mexicanos (PEMEX)

ExxonMobil, BP, Chevron, Petrofac  
Schlumberger, Halliburton Weatherford,  
Baker Hughes / BJ Services, Grupo R  
(Industrial Perforadora de Campeche), Grupo  
Carso (Swecomex and Servicios Integrales  
GSM), Grupo Diavaz/DMGP Servicios de  
Integridad, Grupo TRADECO, Materiales y  
Equipos, Petroleros (Matyep)

Canadian companies doing business in  
Mexico:

TransCanada and ATCO

For a list of local Mexican suppliers:

<http://amespac.org.mx/directorio-asociados/>

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

Research on the effects of the fall in oil prices vary. Some reports state that Mexico was severely impacted. Another report states that Mexico was relatively well protected as the country has a more diversified economic structure than many other oil exporters. In spite of this, there was a fall in production, it did affect the Mexican economy and the government may have to increase non-oil revenues to cover

short-term fiscal deficits and mid-term rate reductions in oil taxes.<sup>117</sup>

## RENEWABLE INDUSTRY

The Mexican government estimates that by 2028 the installed capacity of renewable energy will increase to 19,761 MW. Mexico had invested US\$4 billion in the renewable energy sector in 2015, more than double the amount invested from the previous year.

In August 2015, the government reported a total of 564 private permits were registered to generate electricity from renewable energy sources. The largest source of renewable power generation in Mexico is from hydroelectric power. The largest hydroelectric plant is the 2,400 MW Manuel Moreno Torres at the Chicoasén dam in Chiapas. In the same river basin, the Malpaso and Angostura dams have capacities of 1,080 MW and 900 MW of power, respectively. Another major hydroelectric project, the 750-megawatt La Yesca facility, was completed in November 2012. These larger hydroelectric projects are supplemented by smaller hydroelectric facilities (categorized as lower than 30 MW each) that are being developed by both the public and the private sector. Lastly, in 2015, there were 3,000 MW of hydroelectric projects under development, which demonstrates the continuing importance of hydroelectricity in Mexico.

### GeoThermal

According to Mexico Energy Secretariat (SENER), Mexico has 926 MW of geothermal capacity, making the country 5<sup>th</sup> in terms of global

geothermal capacity. The largest of these geothermal plants is the 720 MW Phase 2 at the Azufres III site. This plant will add another 25 MW in capacity by June 2018.

### Solar Power

Solar power has received significant attention in northern Mexico, where the first large-scale solar power project, Aura Solar I, began operations in 2013. Its capacity is 39 MW. More solar project proposals are being considered as the cost to generate power using solar is now competing with natural gas. The electric power auction held in March 2016 awarded contracts for 12 new solar parks in Mexico.

### Wind Power

In January 2015, the Mexican Wind Power Association, the Federation of Electricity Commission (CFE) and SENER announced US\$14 billion of investments by 2018. These investments represent an increase of almost 7,000 MW bringing the total amount of installed wind energy to 9,500 MW.

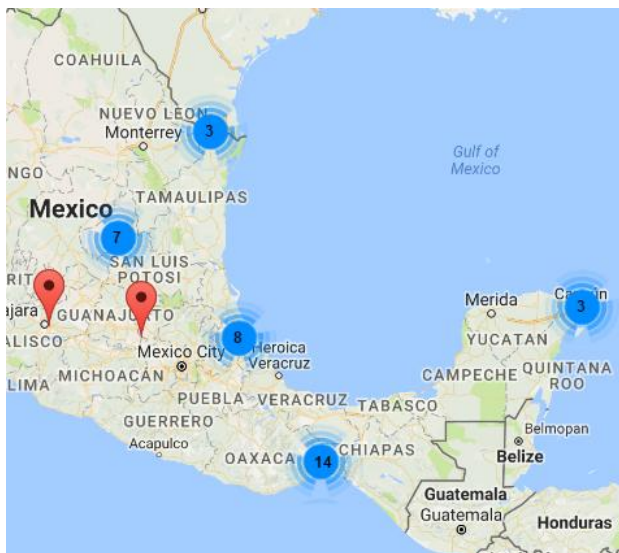
Mexico currently has 47 wind farms. Several wind projects are in development in Mexico's Baja California and in southern Mexico. The plan is to boost Mexico's wind generation capacity from 3 GW in 2015 to 15 GW by 2022. Approximately 90% of the current wind generation capacity is located in Oaxaca, where the Isthmus of Tehuantepec has especially favorable wind resources and has been a focus of government efforts to increase wind capacity.

Continuing the momentum, the Oaxaca region expects an additional 2.5 GW to be operational between 2017 and 2018. In Baja California, Sempra U.S. Gas & Power is developing the 156

<sup>117</sup> The Impact of Lower Oil Prices on the Mexican Economy  
By Adrián Lajous\* December 9, 2014 Columbia Center for  
Global Energy Policy

MW Energía Sierra Juarez 1(ESJ) wind farm. Electricity from the wind farm will be exported to the United States on a new transmission line, powering an estimated 65,000 homes in San Diego County, California. With these developments, and depending on the new US Administration, Mexico is poised to become one of the world's fastest-growing wind energy producers. Companies in the wind industry include, AES Mexico, Goldwind, and Aggreko.

For a full list: <http://www.amdee.org/developers>



**Figure 29 Wind Farm Map Source: The Wind Power**

## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Energy reform aims to promote investment in clean energy and reduce fossil fuel dependency in electricity generation.

In wind power, Mexico currently lacks a full wind supply chain, indicating that any future development will require imports.

Best Prospects:

- Management consultants on new wind projects. Wind power plant construction, particularly in southern Mexico, needs to work with the interests of indigenous communities in the area. Lack of consultation has thwarted the construction of some approved wind projects. This is because information and consent on contracts, land lease agreements and compensations was withheld from local communities.
- Clean energy consulting and education of the benefits of solar energy. People in towns may lack information on the benefits of solar PV rooftop installation, including potential energy bill savings. Meanwhile, rural and off-grid communities may lack information about the possibilities for off-grid or mini-grid electrification.
- Electrical Consulting. Plans are needed for deploying smart grids to increase the beneficial services self-suppliers can provide to the system.
- Biomass Education. Owners of wood resources, particularly in community schemes, do not have the training and structure required to carry out the necessary studies to apply for wood exploitation permits. They may need to bear the extra cost of contracting services from third parties.
- Suppliers of new technologies or more effective methods technologies for processing solid biomass. Plants need to be capable of producing biomass (chips, pellets, etc.) with high calorific value.
- Pre-feasibilities studies for small hydro projects. Small hydropower projects face several barriers. One example is the lack of reliable assessments of generation potential.
- Plants modernization and maintenance
- Metering
- Cogeneration projects

- Parts/supplies for small to medium wind farms

- Petroleos Mexicanos - PEMEX
- Cemex, S.A.B. de C.V.
- Ternium México, S.A. de C.V.
- Valores Quimicos, S.A. de C.V.

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

The Law for the Use of Renewable Energies and Financing the Energy Transition was adopted to reduce GHG emissions and promote the country's clean energy generation goals. The law is meant to define and regulate the use of renewable energy, mainly for power generation.

Targets to generate a share of total electricity from clean energy technologies have been set by the government at 35% by 2024, 40% by 2035 and 50% by 2050.

To help, the government is offering subsidies to Mexican companies in gasoline and diesel. As well, the government has created a market for clean energy certificates (CELS). Wholesale electricity users will be obliged to use 5% of their total consumption from clean energy sources. This will boost clean energy use for electricity generation, particularly in energy intensive industries.

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## **FUNDING INCENTIVES**

The North American Free Trade Agreement (NAFTA) with Mexico gives Canadians a benefit for exporting goods and services. The uncertainty of the USA participation in NAFTA, as well the tensions between the USA and Mexico, could give Canadian suppliers an advantage over their US competitors.

The following companies have access to EDC funding to buy Canadian goods and services:

- Comision Federal de Electricidad (CFE)
- Cotemar S.A. de C.V.
- P.M.I. Trading Limited

The Inter Development Bank and the Clean Technology Fund issue green bonds to fund clean technology projects in Mexico.

<http://www.iadb.org/en/news/news-releases/2015-05-19/energy-efficiency-in-mexico,11161.html>

Please contact your local Global Affairs Canada office for assistance with working with international financial institutions (IFIs).

The Mexican government also created the Fund for the Energy Transition and Sustainable Energy to finance renewable and clean energy projects. Nova Scotia companies would need to partner with a local Mexican company as the lead to access this funding.

<http://inere.energia.gob.mx/publica/version3.2/>

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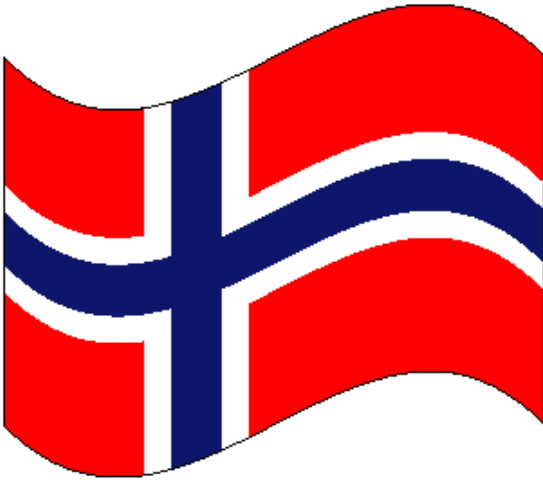
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# NORWAY



## NORWAY COUNTRY PROFILE

### OVERVIEW

Norway is the largest crude oil and natural gas exporter in Europe, supplying most of the continent's petroleum and natural gas. In 2015, Norway was the 3<sup>rd</sup> largest exporter of natural gas in the world after Russia and Qatar.

The oil and gas sector is the dominant industry in Norway, accounting for 15% of its GDP, and contributing 20% of state revenues, 26% of investment and 39% of exports. As a major industry, energy is also a large employer. Norway's oil and gas industry includes more than 1,250 service and supply companies.

The country is equally invested into renewable energy, mostly from hydropower. Norway is also engaged in wind power and biomass.

### Country Facts

Nominal GDP	388.29 Billion USD
Population	5.12 Million
Total Trade/GDP	68.52%
Currency	Norwegian Kroner (NOK)
Merchandise Imports from Canada	1,868.44 Million CAD
Canadian direct investment	1,408 Million CAD
Main imports	Machinery & Equipment, Manufactured Goods, Chemicals

Figure 30 Source: EDC

### COUNTRY SOURCES OF ENERGY

In 2014, electricity generation in Norway was 140 billion kilowatthours (BkWh), of which 136 BkWh came from hydropower, this is approximately 97 percent. The remaining electricity is generated from fossil fuels and other renewables, including wind and biomass.

### CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

Norway's petroleum and other liquids production has slowed in recent years, whereas natural gas production has increased almost every year since 1993.

As other countries try to reposition into renewable energy, Norway is moving forward to further advance their oil and gas industry. To help tackle rising field development costs, the government has put a priority on working with industry to develop a strategy to standardize

solutions. The government is also working with other European countries to further develop the North Sea. A total of 38 crude and natural gas projects are scheduled to start production in the North Sea by 2025, Norway will be responsible for 10 projects (UK 27 and Denmark 1).<sup>118</sup>

In June 2012, government officials from Norway, Germany, and the United Kingdom confirmed plans for subsea electric power connections between their countries to strengthen the northern European electricity grid and to increase supply security. The Norwegian state-owned energy system operator, Statnett, will work with the United Kingdom's National Grid to construct the Norway United Kingdom cable connection. It is expected to be completed in 2021. Statnett will then cooperate with Germany to build the Norway-Germany cable, expected to be completed in 2019.<sup>119</sup>

Norway also signed and ratified the Paris Agreement in 2016. The Norwegian Government intends to take a number of steps to reduce greenhouse gas emissions and promote technological advances. In doing so, the Ministry of Climate and Environment has acknowledged that they must make major cuts to reduce greenhouse gas emissions.<sup>120</sup> To start, the government is establishing a new climate and energy fund, raising the CO2 tax rate for the offshore industry, and improving public transport.

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<sup>118</sup> <http://www.offshore-technology.com/researchreports/researchreportreport-norway-and-uk-to-lead-in-planned-oil-and-gas-production-in-the-north-sea-by-2025-5747465/>

<sup>119</sup> EIA United States Government Norway Market Overview

<sup>120</sup> <http://climateactiontracker.org/countries/norway.html>

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## ENERGY INDUSTRY

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### OIL AND GAS

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There were 80 offshore fields in operation in Norway at the start of 2016, producing around 1.5 MM boe per day. All oil and gas development in Norway is offshore - the Norwegian Continental Shelf (NCS) covers the North Sea, Norwegian Sea and Barents Sea. The Barents Sea and the Northern Norwegian Sea regions are estimated to become the largest contributor to Norway's petroleum production by the end of 2030.<sup>121</sup> The most promising fields are potential modification and satellite projects at Aasta Hansteen, Norne, Skarv, Goliat, and Snøhvit. As well, there are new field developments at Johan Castberg, Wisting, Barents Sea South East; an oil terminal at Veidnes; and an oil spill base either in Lofoten or Vesterålen.

State-run, Statoil, is the dominant company operating approximately 70% of all fields on the NCS. Statoil now ranks as the world's largest operator of fields in over 100m water depth. In 2015, there were 45 operators in total registered on the NCS. The Norway's direct economic interest is managed through state-owned company Petoro. This company is responsible for increasing the value creation with operators.

The service and supply industry is well represented throughout Norway. Most people are employed in the Stavanger region. Clusters of companies with particular sets of skills are located throughout the country. Oslo is known for its capabilities in engineering and seismic companies. Trondheim has a strong position in research and education, while the Bergen region has become a centre for platform maintenance and subsea equipment. In Buskerud, especially in

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<sup>121</sup> Rystad Energy report, "Petro Foresight 2030"

Kongsberg, a strong cluster has been developed related to subsea technology, automation and dynamic positioning equipment. In Southern Norway, there are world-leading companies in drilling technology, and the Ålesund region, has maritime companies that provide a complete shipbuilding and outfitting cluster.

Decommissioning and recycling is a growing industry in Norway. Over the next decade, there are more than 100 platforms forecast for complete or partial removal from both the UK and Norwegian continental shelves with than 1,800 wells are scheduled to be plugged and abandoned and about 7,500 km of pipeline is forecast to be decommissioned.<sup>122</sup> Four facilities have permits to decommission offshore installations in Norway, AF Miljøbase Vats (Rogaland), Aker Stord (Hordaland), Scanmet AS (Hordaland) and Lyngdal Recycling (Vest Agder).

### **Natural Gas**

Norway had 68 trillion cubic feet (Tcf) of proved natural gas reserves as of January 1, 2016.<sup>123</sup> Seventeen new discoveries were made in 2015 in the North and Norwegian Seas, although all were minor and close to other fields. After a long period with no major finds, the Åsta Hansen gas discoveries, Goliat and Johan Sverdrup, have generated renewed belief in large finds on the NCS. Both are to begin production in 2017 and 2019, respectively. The Johan Castberg field in the Barents Sea will start development in 2017 and production to 2022. The field is expected to contain up to 650 million boe.<sup>124</sup>

### **Hydrocarbon Gas Liquids**

Hydrocarbon gas liquids include both natural gas liquids (such as ethane, propane, and butanes) and olefins - produced by natural gas

processing plants, fractionators, crude oil refineries, and condensate splitters. Norway's growing natural gas production has resulted in increasing yields of natural gas plant liquids (NGPL). These yields make Norway Europe's leading producer of NGPL. Concurrently, as natural gas production has grown in Norway, the quantities of recovered NGPL have increased significantly, from 124,000 b/d of oil equivalent in 2000 to 338,000 b/d of oil equivalent in 2015. Most NGPL are produced at the Kårstø processing plant, north of Stavanger. This plant can process about 3.1 Bcf per day of wet natural gas and unprocessed condensate from a number of fields on the Norwegian continental shelf, including Åsgard, Sleipner, and Mikkel.<sup>125</sup>

However, the country has limited land processing and refining facilities. An extensive network of natural gas pipelines (Gassled) operated by Gassco provides distribution to European markets. Gassled is now part-owned by the Canadian Pension Fund Investment Board through its 45% stake in Solveig Gas Norway AS (24.8% of Gassled) and PSP Invest through Infragas (5.0% of Gassled).

Onshore facilities linked to the Gassled network are the Kollsnes gas treatment facility (separating gas and condensate) and the Kårstø processing and condensate facility. Other onshore facilities are the Mongstad oil terminal, Nyhamna, Melkøya, Stura oil terminal, Tjelbergodden methanol plant; and the Vestprosess transportation system and separation facility for NGL.<sup>126</sup>

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### **PROJECTS**

- Statoil recently revealed that it has been able to revive development plans for Johan Castberg based on a FPSO solution. The oil field development was previously considered a cost challenge

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<sup>122</sup> <http://oilandgasuk.co.uk/category/operations/>

<sup>123</sup> Oil & Gas Journal 2016

<sup>124</sup> Canadian Trade Commissioner Service Norway

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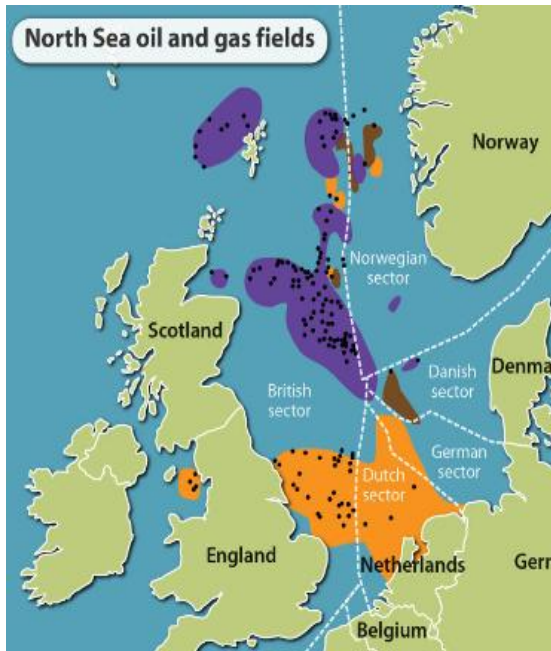
<sup>125</sup> US Energy Information Administration

<sup>126</sup> Canadian Trade Commissioner Service Norway



with the oil price sinking to below \$30 per barrel and a possible need for a land-based terminal.

- Lundin Norway has encountered oil and gas in the drilling programmes of wildcat well 7219/12-1 and appraisal well 7219/12-1 A (Filicudi) in the Barents Sea.
- ABB has signed a project-specific agreement to provide safety and automation systems for Statoil at the Johan Castberg oilfield off the coast of Norway. Statoil has issued the first call-off from the agreement covering front-end engineering and design (FEED).
- Wintershall Norge has submitted the development concept of the North Sea's Skarfjell field to Norway's Ministry of Petroleum and Energy of in a 'decision to continue' (BOV) report.
- Project operator Wintershall, along with other licence partners, decided that the Skarfjell reservoir would be connected to the nearby Gjøa platform through a subsea tie-back. Wintershall Norge holds 35% interest in PL 418 with operatorship. The remaining stakeholders are Capricorn Norge (20%), Bayergas Norge (20%), Edison Norge (15%) and DEA Norge (10%).
- Oil firm start-up Wellesley Petroleum plans to secure around 40 licences in the oil and gas fields in offshore Norway. The company intends to take part in around six wells every year. Through an investment agreement with Bluewater Energy and affiliates, Wellesley Petroleum has access to an equity line of up to US\$250m.
- Statoil has submitted a plan for development and operation of Trestakk discovery on the Halten Bank to the Norwegian Ministry of Petroleum and Energy.
- April 2017, Wood Group has received a contract from Statoil to provide a front-end engineering and design (FEED) study for the subsea flow-line system of Snorre Expansion Project in the Norwegian North Sea.
- Norway's Ministry of Petroleum and Energy has approved the plan for development and operation (PDO) of the Statoil ASA-operated Trestakk discovery on the Halten Bank in the Norwegian Sea. Field development comprises a subsea template and a tied-in satellite well. Three production wells and two gas injection wells also will be drilled. Statoil estimates that the field has recoverable volumes of 76 million boe, most of which is oil. Tied in to the Asgard A production vessel, Trestakk is expected to come on stream in 2019.
- Eni Norge AS plans to drill two subsea wells in Goliat field to start production from the Snadd discovery in the Barents Sea offshore Norway. The Snadd reservoir lies between the Realgrunnen and Kobbe reservoirs, which already are producing. The Norwegian Petroleum Directorate (NPD) estimates this will increase Goliat's oil reserves 7.5 million bbl to about 200 million bbl. Snadd was mentioned in Goliat's plan for development and operation (PDO). NPD has approved Eni's application for a PDO exemption.
- On March 29, 2017 ExxonMobil agreed to sell its operated upstream business in Norway to private equity firm HitecVision and oil company Point Resources.



**Figure 31 Oil and Gas Map Source: Crystal Energy**

## GOVERNMENT REGULATIONS AND POLICIES

Norway was world renown for developing its oil and gas industry by setting standards and policies for foreign companies, including a local content plan, training, and research and development agreements. Today, there is no definition of "local content" in Norwegian law.

Norway's oil and gas tax policies are significant drivers for the offshore energy sector. The government refunds 78% of exploration costs to companies and reduces taxes on exported LNG. The tax regime contributes to the sector's stability.

In 2013, the Norwegian government announced that it would cut the tariff rate for natural gas pipelines by 90% as of January 1, 2016. The Canadian pension funds and some other investors filed a lawsuit claiming that the tariff

reduction was illegal and financially damaging. In October 2015, the court ruled against the investors. The investors appealed the decision, with the appeal hearing set to begin in 2017. Norway is generally a low risk country for investors, where these types of disputes are rare.<sup>127</sup>

## CERTIFICATION AND STANDARDS

The Norwegian Standards Authority is responsible for standardization, certification and assessment. In 2014, the country standardized steel forgings.<sup>128</sup>

NORSOK<sup>129</sup> standards are used for offshore projects. A number of companies also use prequalification systems to assess potential suppliers. Aker Solutions and Technip both have their own systems, while Statoil and a number of other companies use Achilles JQS<sup>130</sup>. The Achilles system involves an annual fee and involves an assessment process.

It is recommended that all companies wishing to deliver goods or services to the Norwegian oil and gas industry must prequalify in the Joint Qualification system Achilles.

<https://www.achilles.com/images/pdf/communitypdfs/JQS/jqs-requirements-en.pdf>

<sup>127</sup> Canadian Trade Commissioner Service Norway

<sup>128</sup> <http://nortrade.com/sectors/articles/standardization-key-during-low-oil-price/>

<sup>129</sup> <http://www.standard.no/en/sectors/energi-og-klima/petroleum/>

<sup>130</sup> <http://www.achilles.com/en/communities/822-jqs>

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## MAJOR COMPANIES

StatOil

Production Norway AS

Storebrand Asa

Total E&P Norge AS

Conocophillips Norge

Klp Ranheimsveien 10 AS,

Orkla Asa

National Oilwell

Varco

Norway AS

Seadrill Norge AS

Eni Norge AS

Point Resources

Aker BP

For a list of local Norwegian suppliers:

<https://www.norskoljeoggass.no/en/>

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## WORKING IN NORWAY

The Norwegian subsea industry has built considerable expertise in deep water operation. It presents a challenging market for new entrants.

Market Strengths:

- Vast natural resources
- Efficient business culture
- Low levels of corruption

Market Challenges:

- Mature market, highly competitive
- The oil and gas industry had massive job cuts, however leading indicators points

toward the employment increasing in 2017<sup>131</sup>

The Confederation of Norwegian Enterprise (NHO the Norwegian Oil and Gas Association) is a central party to agreements between employers and unions. It works to ensure that the oil and gas sector offers attractive working conditions in line with practice in Norwegian industry.

The Danish Embassy handles all applications for visa and residence permits for Norway (and all of the Scandinavian countries) for Canada. Canadian citizens can visit Norway for up to 90 days without a visa. However, if the travel is for work or the visitor plans to stay longer than 90 days, a Residence Permit application is required.

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

World Energy City Partnership member is Stavanger, home to the Offshore Northern Seas Conference.

New technology to support the development of Norway's oil and industry will be crucial for its continued success. Companies that have technologies to improve efficiency, reduce risk, environmental impact, operating and exploration costs will have an advantage entering this market.

Norway is strong in subsea systems and working in harsh climates; however the industry still needs advanced goods and services.

Best Prospects:

- Interpretation of seismic data
- Subsea processing
- Information technology and communication technology
- New drilling technologies in pressure and temperature reservoirs

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<sup>131</sup> Dankse Bank Nordic Outlook 2017

- Field life extension services
- Enhanced/improved oil recovery (ior/eor) technologies
- Maintenance and modification work
- Consulting to standardization of efficiency solutions
- Electrifications from shore

Norway's efforts to expand oil and gas exploration in the Arctic Circle may also present opportunities.

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

With the slow down, over 15,000 workers in the oil and gas industry lost their jobs. This unemployment is expected to be temporary as the country is moving forward with new exploration projects.

Statoil had also reduced its spending. And, with the direction of the government, the company has been working on a number of initiatives to help standardize petroleum field developments. It is currently heading an improvement program called STEP (Statoil Technical Efficiency Program) that focuses on standardization and industrialization as one of its six high impact projects.

Despite the low price of oil and overall declining production, the economy in Norway is projected to maintain relatively stable. The lower prices are likely to contribute to closures of small and underperforming fields.

## **RENEWABLE ENERGY**

Electricity production in Norway is mostly flexible hydropower. Wind and thermal energy are also contributors to Norway's electricity.

### **Hydropower**

Hydropower has been the basis of Norway's energy industry since the late 1800s. The largest renewable energy power generator in Europe is Statkraft, which is owned by the Norwegian state and is a major supplier of hydropower.

Norway's electric grid is owned and operated by Statnett. Statnett is responsible for ensuring the reliability and efficiency of the electric grid and for balancing electricity supply and demand. The company is owned by the Norwegian state, and its revenues from operating the grid are regulated by the Norwegian Water Resources and Energy.

### **Wind Power**

Norway has 48 onshore farms. The Ministry of Petroleum and Energy is currently researching the potential of offshore wind farms. The 15 potential Norwegian offshore wind fields could produce 18 to 44 TWh.

Companies in the Norway Renewable Energy Industry:

- Statoil
- Sway
- Fred Olsen Renewables
- METCentre
- NTE FKF
- Solvind
- Statkraft

For a full list:

<http://www.intpow.no/index.php?categoryid=3>

Also, a new DNV GL joint industry project plans to harness wind power to inject water into mature fields and enhance oil recovery. DNV GL, an international certification body headquartered in Norway, has proposed a new

concept called WIN WIN (WIND powered Water INjection)<sup>132</sup> that will use the floating wind turbines proven offshore technology to power water injection at offshore fields. DNV GL invited companies to join its Joint Industry Project (JIP) to carry out an in-depth study of the concept.<sup>133</sup>

In 2016, construction began of the 1 GW Fosen Vind project. Norway plans to import excess wind production at low prices from Denmark and the Netherlands. The government is considering new transmission lines to do the same with Scotland and Germany sometime after 2020.<sup>134</sup>



**Figure 32 Wind Farm Map** Source: The Wind Power

### Battery Energy

In 2015, the Norwegian government announced the Green Coastal Shipping Program as a public-

<sup>132</sup> <https://www.dnvgl.com/energy/feature-articles/win-win-wind-powered-water-injection.html>

<sup>133</sup> <http://nortrade.com/sectors/articles/from-oil-to-wind-back-again/>

<sup>134</sup> [https://en.wikipedia.org/wiki/Renewable\\_energy\\_in\\_Norway](https://en.wikipedia.org/wiki/Renewable_energy_in_Norway)

private initiative with the key players in the Norwegian coastal shipping industry. The goal of the program is to create a future Norwegian fleet run entirely, or partly, on batteries, LNG and other eco and bio fuels. The program will include all mode of water transportation, from offshore vessels, ferries, container ships, tankers, and aquaculture and fishing vessels, to tug boats. A purely battery driven ferry can reduce fuel cost by 30 – 80 percent.<sup>135</sup>

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Energy efficiency solutions are being employed across the renewable energy sectors.

Best Prospects:

- New technologies
- Energy efficiency technologies
- Smart metres
- Offshore wind farm consulting

Technology Transfer: Nova Scotia could benefit from learning about Norway’s battery energy powered sea vessels and how the province can introduce this technology locally.

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

Norway has an active national climate policy and uses a wide set of measures to reduce domestic emissions. Approximately 80% of the Norwegian emissions are subject to economic instruments such as CO2 taxes or quotas. Norway has committed to reduce the global emissions of

<sup>135</sup> <http://nortrade.com/sectors/articles/norways-future-green-fleet/>

greenhouse gas before 2020 equivalent to 30% of the emissions of 1990. The government is promoting the development of new technologies as one of several measures they are using to reduce emissions.

The Technology Centre Mongstad (TCM) in Norway is the world's largest facility for testing and improving CO2 capture. Knowledge gained will prepare the ground for CO2 capture initiatives to combat climate change. TCM is a joint venture between the Norwegian state, Statoil, Shell and Sasol.<sup>136</sup>

Enova SF promotes environmentally friendly production and consumption of energy in Norway. The organization explores new sources of clean energy to reduce overall energy consumption, and to provide educational materials to the public promoting energy-efficient practices. Enova SF is financed through government funding in addition to a tariff of one øre per kWh of electricity to consumers. The company is owned by the Norwegian Ministry of Petroleum and Energy and based in Trondheim.<sup>137</sup>

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## FUNDING INCENTIVES

The following company has access to EDC funding to buy Canadian goods and services:

- Lundin Petroleum

The Research Council of Norway is responsible for administering most of the public funding available for energy research. The funds are used for basic research, industrial research and societal research. Nova Scotia companies

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<sup>136</sup> [http://www.emb-norway.ca/norway\\_and\\_canada/Political-Priorities/Norway---an-energy-nation/](http://www.emb-norway.ca/norway_and_canada/Political-Priorities/Norway---an-energy-nation/)

<sup>137</sup> Wikipedia

should partner with a Norwegian company on funding applications.

[http://www.forskningsradet.no/en/Find\\_calls\\_for\\_proposals/1184150364108](http://www.forskningsradet.no/en/Find_calls_for_proposals/1184150364108)

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## OTHER SOURCES OF INFORMATION

UK Government Country Profile  
Norway <https://www.gov.uk/government/publications/>

US Commercial Service  
<https://www.export.gov/search#/search/articles?q=norway&k=9lk4e9>

US Government EIA Country Analysis Brief – Norway [https://www.eia.gov/beta/international/Offshore Technology: http://www.offshore-technology.com](https://www.eia.gov/beta/international/Offshore%20Technology)

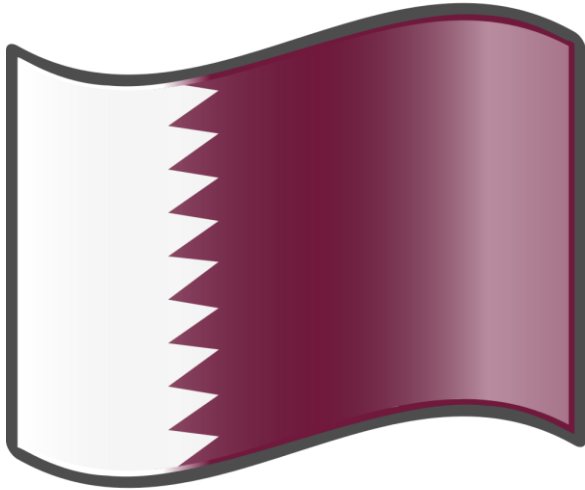
Canadian Trade Commissioner Service Norway  
<http://tradecommissioner.gc.ca/norway-norvege/index.aspx?lang=eng>  
Decommissioning of Offshore Installations. Climate and Pollution Agency, Oslo, February 2011

Offshore Technology.com

Oil & Gas Journal [ogi.com](http://www.ogi.com)

## NOTES:

# QATAR



## Country Facts

Nominal GDP	166.51 Billion USD
Population	2.24 Million
Total Trade/GDP	91.09%
Currency	Qatari Riyal (QAR)
Merchandise Imports from Canada	177.77 Million CAD
Main imports	Machinery & Appliances, Base Metals, Auto & Light Motor-vehicles, Food, Beverage & Tobacco

Figure 33 Source: EDC

## QATAR COUNTRY PROFILE

### OVERVIEW

Qatar is the largest exporter of liquefied natural gas (LNG) in the world, accounting for 60% of the country's gross domestic product (GDP). The growth in Qatar's natural gas production has also increased Qatar's total liquids production in lease condensates, other petrol liquids and natural gas plant liquids. The country is at the forefront of gas-to-liquids (GTL) production, and is home to the world's largest GTL facility.

Qatar does not at present have any specific legislation for the promotion of renewable energy. Nevertheless, its government is demonstrating a clear commitment to diversify its economy by promoting sustainability, investing in research and development, and funding state-owned projects.

### COUNTRY SOURCES OF ENERGY

Qatar's electricity grid is fueled by over 80% natural gas; the remainder is crude oil and natural gas liquids. Between 2000 and 2012, Qatar's electricity consumption grew from approximately 8.0 billion kilowatthours to 32.7 billion kilowatthours.

### CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

To meet rising electricity demand, Qatar continues to invest in its electricity generation capacity. Qatar plans to boost generating capacity to 13 GW by investing in new generation capacity at Umm Al Haul and Ras Laffan water power plants. These two project expansions will increase Qatar's generation capacity 51% by 2018.

The country's global liquids production is estimated to increase by over 1.6 million barrels per day by the end of 2017. Despite high global inventories, global demand is expected to outpace the projected supply.

Lastly, propelling the country's commitment to renewable energy is the 2022 World Cup which will be hosted by Qatar. The World Cup is expected to create rapid deployment of more renewable technologies and green energy construction as the country aims to honour its pledge to host a low carbon event.

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## ENERGY INDUSTRY

### OIL AND GAS

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In 2014, Qatar exported nearly 4.3trn scf of natural gas. In addition to being the world's largest LNG exporter, Qatar is also the world's fourth-largest dry natural gas producer, after the US, Russia and Iran. As of January 2015, the country contains the world's 3<sup>rd</sup> largest proven reserves of gas at 872trn standard cu feet (scf). Natural gas production is used to fuel the production of the country's petrochemical industry.

Qatar has long-term oil-indexed contracts. However, in recent years, the state has shifted to short-term contracts and spot market sales. This structure provides the state with considerable insulation against an influx of new LNG projects coming on-line in the next several years from Australia and North America.

Qatar's energy sector is vast, complex, and encompasses state-owned and privately run companies. The state's dominant energy company, Qatargas (QP), has production capacity of 42m tonnes per annum (tpa), and is the largest LNG-producing company in the world. Qatargas controls all aspects of the

country's upstream and downstream oil and natural gas sectors, from exploration and production to transportation, storage, marketing and sales.

The company also works with the consortium of Total, ExxonMobil, Mitsui, Marubeni, ConocoPhillips and Shell under exploration and production-sharing agreements (EPSAs), as well as development production-sharing agreements. Qatargas and its subsidiaries operate at onshore locations including Doha, Dukhan, and the Mesaieed and Ras Laffan industrial cities; offshore activities on Halul Island, North Field; and other offshore production stations and drilling platforms.

RasGas is the country's second-largest LNG company. It operates three major LNG ventures, known as RasGas Laffan I-III. QP holds a 70% stake in the firm and ExxonMobil holds 30 percent. The two companies offer a combined capacity of 77m tpa and handle their own upstream, downstream and transport operations, although both charter LNG vessels from Qatar Gas Transport Company (Nakilat) for export shipments.

It has been over 20 years since Qatar has had a significant gas find. The industry is now moving towards improving efficiency and productivity at existing fields in a bid to prolong the field's lifespan. Enhanced oil recovery (EOR) techniques such as water flooding and horizontal drilling are at the forefront of the sector for field extension.

In 2012 the government decided to pursue an ambitious strategy aimed at boosting petrochemicals production from approximately 9m tpa to 23m tpa by year 2020. Unfortunately, in 2014 Qatar's state-owned petrochemicals and steel producer, Industries Qatar, announced that it was shelving plans to build a US\$6bn



petrochemicals project known as Al Sejeel. Additionally, QP and Shell cancelled its planned US\$6.4bn joint venture, the Al Karaana petrochemicals project. It had been expected to include a mixed-feed steam cracker producing ethylene and propylene. The project was deemed not financially feasible. The upside to the cancellation was state-owned petrochemical players were able to expand their operations using the feedstock that had been reserved for the Al Karaana project.

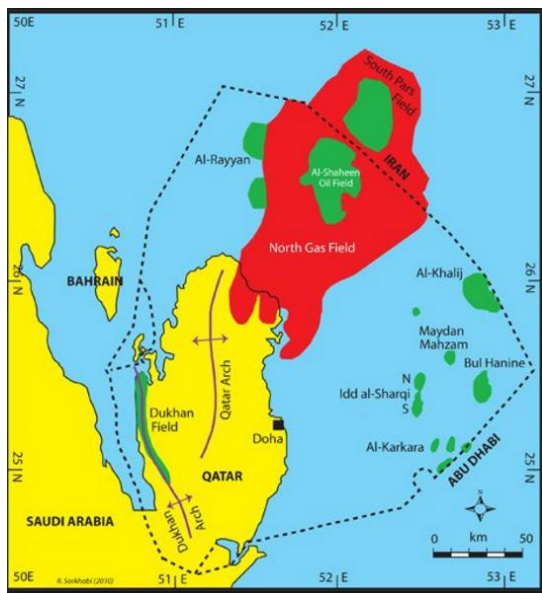


Figure 2 Oil and Gas Map Source: GeoExpro

## PROJECTS

- Total has signed an agreement to obtain a 30% interest in the concession covering the offshore Al-Shaheen oilfield from Qatar Petroleum (QP).
- Qatar Petroleum has signed an agreement with Air Energi to supply contract personnel to support the company's US\$11bn development project at the Bul Hanine oil field.
- SPX Bolting Systems in the Middle East, with support from its UK counterpart, has secured a US\$1.2m order to supply

tools and equipment for a major five-year maintenance shutdown program in the LNG sector.

## GOVERNMENT REGULATIONS AND POLICIES

The Ministry of Business and Trade requires all importers to register to get an import licence. These are only issued to Qatari nationals. This regulation also applies to wholly foreign owned entities operating in Qatar.

Certain sectors are not open for domestic or foreign competition, including public transportation, electricity and water, steel, cement, and fuel distribution and marketing. In these sectors, a single semi-public company has complete or predominant control.

When approving majority foreign ownership in a project, the law states that the project should fit into the country's development plans. It adds that preference should be given to projects and services from Qatar. This includes the use of raw materials, manufacturing and production. Foreign companies must also facilitate the transfer of technology and know-how to Qataris, and promote the development of national human resources.<sup>138</sup>

Law No. 13-2000 does however permit foreigners, upon approval, to own up to 100% of any investment made in the energy and mining sectors.

## CERTIFICATION AND STANDARDS

Qatar adheres to international standards and management systems for its oil and gas industry. Workers are recommended to have the NEBOSH

<sup>138</sup> <https://www.export.gov/article?id=Qatar-openness-to-foreign-investment>

International Technical Certificate in Oil and Gas Operational Safety.<sup>139</sup>

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## WORKING IN QATAR

Foreign firms are required to use a local agent for matters related to sponsorship and residence of employees. Most businesses setting up in Qatar must have 51-49% split in favour of the Qatari partner.

### Market Strengths:

- Economic stability
- Modern, fast-growing, diversifying economy
- High personal wealth
- Strong government support for infrastructure and related projects

### Market Challenges:

- High levels of bureaucracy
- Price, rather than quality, most important factor in the buying decision
- Market not well regulated, especially on environmental matters
- Delays in payment
- Highly competitive and saturated market in some sectors
- Rents for both business and private residences expensive and rising
- Qatari riyal is tied to the US dollar, so when the dollar exchange rate is strong, Qatar becomes an expensive market

A business visa is required for Canadians working in Qatar. For those who are working in many countries, take caution as Canadians have been denied entry into Qatar because their passports bore an Israeli visa, an Israeli border stamp or an Egyptian or Jordanian border stamp

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<sup>139</sup> <https://www.nebosh.org.uk/>

issued by an office bordering Israel. Such a stamp would indicate the traveler entered from Israel.<sup>140</sup>

In the industrial sector, Qatar has tax free zones to attract direct foreign investment. These free zones currently include the Qatar Financial center and Qatar Science and Technology Park. Within the free trade zone, companies have unrestricted repatriation of capital and profits, zero tax and duty-free imports of goods and services and tax free zones.

### Other Benefits:

- An investor may operate as a branch of a foreign company or register a local company
- Foreign ownership of 100% is permitted.
- A company may exercise its business without a sponsor or a local agent
- An investor may sponsor foreign employees

### For more information:

<http://www.qdb.qa/English/Investing/Pages/QatarTax.aspx>

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Doha, Qatar is member of the World Energy City Partnership. Qatar is interested in exploring new ways of enhancing gas extraction so it's cleaner, greener and more efficient.

### Best Prospects:

- Education and training for LNG
- Field maintenance
- New technologies for extraction

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<sup>140</sup> <https://travel.gc.ca/destinations/qatar>

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## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

Despite lower oil prices, real economic growth in 2016 was expected to rise to 3.9 percent. The strength was due to the non-hydrocarbon sector and the boost to upstream hydrocarbon production from the Barzan gas project. However, the gross domestic product (GDP) was expected to contract. In 2017 and 2018, hydrocarbon production are predicted to plateau, but solid expansion in non-hydrocarbon activities will sustain overall economic development.

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### MAJOR COMPANIES

Qatargas  
Ras Gas  
ExxonMobil Qatar Inc  
Qatar Petrochemical Company  
Total E & P Qatar  
Chevron International Gas Inc.  
ConocoPhillips  
Encana International Qatar Ltd.  
GE Oil and Gas  
Maersk Oil Qatar AS  
Occidental Petroleum of Qatar Ltd  
Qatar Fuel (WOQOD)  
Qatar International Petroleum Marketing Co. Ltd  
(Tasweeq)  
Qatar Petroleum (QP)  
Qatar Petroleum Refinery (QPR)  
Qatar Shell Services Co. WLL  
Sasol  
Seef Limited  
Statoil  
Yokogawa Middle East EC

## RENEWABLE INDUSTRY

Qatar has one of the highest carbon emissions per capita in the world. The country is seeking to generate 20% electricity from renewable energy by 2030.<sup>141</sup> Qatar Electricity and Water Company and Qatar Petroleum are planning to join forces to set up a US\$500 million joint venture company with the purpose of investing in renewable energy projects, mainly in solar energy. The country plans to set up 1,800 MW in solar power capacity by 2020. This is expected to contribute up to 16% of total power generation.

### Hybrid Wind and Solar Base Station

Vodafone Qatar Q.S.C. and Alcatel-Lucent announced the development of the first hybrid powered Base Station in Qatar, using a combination of solar and wind energy.

### Solar Powered Cooled Stadiums

Qatar, as host of the 2022 World Cup, will use solar technology at all five stadiums, and also at fan zones and training facilities. Generators using biofuels will supplement electricity from the national grid to ensure that there is enough capacity to cool the stadium during matches. Surplus energy will be exported back to the grid. The amount of electricity generated is intended to exceed the amount of electricity imported for events over the year, making the facility carbon neutral.

### Chevron Qatar Energy Technology and GreenGulf Inc.

A Qatar-based renewable energy and clean technology company, has signed a memorandum of understanding for a joint study

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<sup>141</sup> IRENA Renewable Energy Market Analysis The GCC Region 2016

to test solar energy technologies and their application in Qatar. The research will be performed at Qatar Science & Technology Park (QSTP).<sup>142</sup>

### **Qatar Sustainable Water and Energy Utilization Initiative (QWE)**

The QWE, based at the Texas A&M University at Qatar, is looking at sustainable uses for water and energy by bringing together the industrial sectors and research and educational institutions. The QWE currently operates research and development projects, covering energy efficiency by the development of energy recovery and reuse and seawater for process cooling projects.

### **Renewable Energy-Based Desalination**

Faced with limited naturally renewable water resources, countries such as Qatar have turned to seawater desalination options, which now provide 87% of total water in Qatar. Desalination is an expensive and energy-intensive process. The government is exploring affordable and sustainable options to power desalination. Renewable options, especially those based on solar energy, are gaining increasing prominence in desalination.<sup>143</sup>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

There is a growing interest in the emirate in tapping alternative and sustainable sources using solar and wind (to a lesser extent). Companies with experience in solar power have the best advantage in this market.

Best Prospects:

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<sup>142</sup> <http://www.qstp.org.qa/>

<sup>143</sup> [http://www.irena.org/DocumentDownloads/Publications/I\\_RENA\\_Market\\_GCC\\_2016.pdf](http://www.irena.org/DocumentDownloads/Publications/I_RENA_Market_GCC_2016.pdf)

- HVAC technologies in advance cooling and ventilation systems that use green energy
- Training and education alternative power
- Planning engineers
- Solar technicians
- Project managers energy management
- Consulting services wind power

Nova Scotia companies could also investigate the desalination technology and transfer this knowledge globally.

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

Qatar's commitment to renewable energy was to the United Nations through the Intended Nationally Determined Contribution (INDC).<sup>144</sup> Qatar does not at present have any specific legislation to facilitate the development of renewable energy. However, the government is investing in renewables projects and making investments in the development of renewables technologies.

Qatar is established as the leader in non-renewable energy; the emirate is now setting its sights on becoming a leading exporter of renewable energy. In doing so, Qatar and the US Department of Energy (DOE) signed a memorandum of understanding to promote collaboration on the development and deployment of cost-effective and sustainable clean energy technologies.

The DOE, principally through the Advanced Research Projects Agency - Energy (ARPA-E), and QSTP will pursue cooperation in five key areas:

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<sup>144</sup> <https://cleantechnica.com/2016/01/01/500-million-renewable-energy-joint-venture-planned-qatar/>

- Advanced Cooling Technologies
- Renewable Power Generation
- Energy Storage
- Carbon Capture and Sequestration
- Water Treatment Systems, including efficient desalination techniques and effective water purification.<sup>145</sup>

volatility-country-remains-leading-player-oil-and-gas

Offshore Shore Technology – Qatar  
[www.offshore-technology.com](http://www.offshore-technology.com)

**Notes:**

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**FUNDING INCENTIVES**

SMEs in Qatar can apply for a product development and tech venture fund through the Qatar Science and Technology Park. Nova Scotia companies would have to partner with a Qatari company.

<http://www.qstp.org.qa/home/funds/product-development-fund>

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**OTHER SOURCES OF INFORMATION**

US Government EIA Country Analysis Brief – Qatar <https://www.eia.gov/beta/international/>

IRENA RENEWABLE ENERGY MARKET ANALYSIS THE GCC REGION <http://www.irena.org>

Qatar Economic Outlook 2016–2018  
 Issue Number 10 Qatar Ministry of Planning, Development and Statistics  
<http://www.mdps.gov.qa/en/pages/default.aspx>

UK Government  
<https://www.gov.uk/government/publications/exporting-to-qatar/doing-business-in-qatar-qatar-trade-and-export-guide>

Oxford Business Group  
<https://www.oxfordbusinessgroup.com/overview/market-share-matters-despite-global-price->

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<sup>145</sup><http://www.nortonrosefulbright.com/knowledge/publications/48660/renewable-energy-in-qatar>

# SAUDI ARABIA



## SAUDI ARABIA COUNTRY PROFILE

### OVERVIEW

The Kingdom of Saudi Arabia contains 16% of the world's proved oil reserves. The country is the largest exporter of total petroleum liquids, and maintains the world's largest crude oil production capacity.

Saudi Arabia's economy remains heavily dependent on petroleum. Petroleum exports accounted for 85% of total Saudi export revenue, according to the Organization of the Petroleum Exporting Countries (OPEC).

In April 2017, the country is introducing new renewable energy projects to ensure it maintains its position as a world energy supplier. There is a lot of global interest from foreign companies to compete for these projects.

### Country Facts

Nominal GDP	646.00 Billion USD
Population	30.38 Million
Total Trade/GDP	72.53%
Currency	Saudi Riyal (SAR)
Merchandise Imports from Canada	1,195.94 Million CAD
Canadian direct investment	33 Million CAD
Main imports	Machinery & Equipment, Food, Beverage & Tobacco, Chemicals

Figure 34 Source: EDC

### COUNTRY SOURCES OF ENERGY

Saudi Arabia is the largest consumer of petroleum in the Middle East, particularly in the area of transportation fuels and crude oil for power generation. The country's energy mix is from petroleum at 60%, with natural gas accounting for most of the rest.

The country, or kingdom, produces very little renewable energy, representing less than 1% of the total energy produced. However, under an economic reform program approved by King Salman in 2016, the targets for renewable energy are 3,450 megawatts to the national energy mix by 2020, equating to 4% of energy use in the kingdom.<sup>146</sup>

<sup>146</sup> <http://fortune.com/2017/01/16/saudi-arabia-renewable-energy-program/>

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

By 2032, anticipated demand for electricity in Saudi Arabia is expected to exceed 120 GW. The overall demand for fossil fuels for the power industry, transportation and desalination is estimated to grow from 3.4 million barrels of oil equivalent per day in 2010 to 8.3 million barrels per day in 2028.

To try and thwart this growth in demand, the kingdom is embarking on new energy conservation measures. Saudi Arabia has created the King Abdullah City for Atomic and Renewable Energy (K.A. CARE) program. The program will utilize a balanced mix of economically viable and technically feasible atomic and renewable energy in a sustainable manner to generate power and preserve the kingdom's resources of oil and gas.<sup>147</sup>

Moreover, the creation of this program is not all about becoming a greener society. The increased use of renewable sources will allow for more oil and natural gas originally allocated for domestic power, to be freed up for export. In the interim, Saudi Arabia is participating in the Gulf Cooperation Council's efforts to link the power grids of member countries to reduce shortages during peak power periods.

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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The Kingdom of Saudi Arabia maintains conventional crude oil reserves at 260.1 billion barrels. More than half of Saudi Arabia's oil reserves are contained in eight fields. The Ghawar field is the world's largest field with

estimated remaining reserves of 75 billion barrels.

Saudi Arabia's oil and natural gas operations are dominated by the national company Saudi Aramco (the Saudi Arabian Oil Company) or often referred to as Aramco. It is the world's largest oil company in terms of production. Saudi Arabia's Ministry of Petroleum and Mineral Resources and the Supreme Council for Petroleum and Minerals have oversight of the oil and natural gas sector and Saudi Aramco.

In 2015, Saudi Aramco produced 9.5 million barrels per day of crude oil and 12.4 billion standard cubic feet per day of natural gas. The company exported in excess of 2.5 billion barrels of oil and 416.3 million barrels of natural gas liquids.

Saudi Aramco currently operates at least 16 offshore fields. In its capital investment program for 2012-18, Saudi Aramco allocated US\$8 billion for the development of six offshore facilities out of a total operating budget of US\$60 billion.

Saudi Aramco continues to identify new fields, expand existing fields, and enhance production. Four new fields and a new gas field were recently discovered with maximum sustainable crude production capacity of 10.3 million barrels per day.

To meet increasing global oil demand, Saudi Aramco presently has 12 upstream and downstream investment projects valued at approximately US\$80 billion. By 2020, Saudi Aramco's daily production capacity of 12.5 million b/d will increase to 15 million b/d.

Unassociated gas is also a priority for Saudi Aramco. This type of gas presently accounts for 44% of the Kingdom's primary energy consumption. Saudi Aramco is targeting a 30%

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<sup>147</sup><https://www.kacare.gov.sa/en/FutureEnergy/Pages/vision.aspx>

increase in sales of gas output to 10 billion cubic feet per day (cf/d).

The kingdom's domestic natural gas market was traditionally the sole domain of Saudi Aramco. It is now slowly being opened to private investment both in exploration and distribution, and to increasing competition in the market. The key component of the unassociated gas exploration strategy relies on foreign consortiums exploring for onshore gas and condensate in the Rub al-Khali. In the English language, this is the Empty Quarter. The field encompasses most of the southern third of Saudi Arabia.

Saudi Aramco has also switched its focus to the offshore Karan field discovered in 2006. Karan is 100 km north of the giant Ghawar oil field. Under the Wasit gas development program, Saudi Aramco discovered the Arabiyah and Hasbah fields in January 2009. The Wasit gas development program will extract and process up to 2.5 billion cf/d of sour gas from the offshore Arabiyah and Hasbah fields.

Unfortunately, Saudi Arabia has had four failed upstream joint ventures in the Empty Quarter:

- South Rub al-Khali Company, or SRAK, (a venture of Saudi Aramco and Royal Dutch Shell). In 2014, Shell ended its exploration of the Empty Quarter.
- Luksar Energy Limited (a venture of Saudi Aramco and the Russian oil company, Lukoil). In 2010, Luksar gave up 90% of its exploration area to focus on a smaller area with possible gas discoveries.
- Sino Saudi Gas Limited (a venture of Saudi Aramco and Sinopec).
- EniRepSa Gas Limited (a consortium of Saudi Aramco, the Italian oil company, Eni, and the Spanish oil company,

Repsol). In 2012, both Eni and Repsol pulled out of the joint venture.

As of July 2014, all of these ventures did not make significant commercial discoveries, in part because development costs would be far higher than Saudi Arabia's official domestic natural gas price.<sup>148</sup>

Saudi Aramco also operates the world's largest oil processing facility and crude stabilization plant at Abqaiq. Its crude processing is at the capacity of seven million bbl/d. More than 70% of Saudi crude is processed at Abqaiq before export or delivery to refineries. Saudi Arabia has eight domestic refineries, with a combined crude throughput capacity of about 2.5 million bbl/d (of which Aramco's share is approximately 1.8 million bbl/d). Saudi Arabia continues to integrate its refinery projects with large petrochemicals complexes, in what has been described as the creation of petrochemical cities.

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## PROJECTS

- McDermott International has been contracted by Saudi Aramco to provide engineering, procurement, construction and installation (EPCI) of four jackets and offshore three gas observation platforms.
- Rowan Companies and Saudi Aramco have signed an agreement through their subsidiaries to create a joint venture to own, operate and manage offshore drilling rigs. The new company will use Rowan's established business in the country as its base. The scope of operations for this joint venture includes Saudi Arabia's existing and future offshore oil and gas fields. The new company will commence operations from Q2 of 2017.

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<sup>148</sup> EIA Country Analysis Brief 2014



- Saudi Aramco has signed a memorandum of understanding with GE and Italy's Cividale to build a new forging and casting manufacturing facility in Ras Al-Khair, to serve the maritime and energy industries.



Figure 2 Oil and Gas Map Source: Saudi Aramco

## GOVERNMENT REGULATIONS AND POLICIES

In 2015, Saudi Aramco launched its In-Kingdom Total Value Add (IKTVA) program, aimed at increasing investment, economic diversification, job creation and work force development within the Kingdom of Saudi Arabia. Currently local content rules (LCR) are 30-35 percent. The company plans to increase this figure to 70% by 2021.<sup>149</sup> Saudisation (Nitaqat) is a Saudi policy which aims to create better employment prospects for Saudi citizens, and rely less on imported foreign labour.

<sup>149</sup> [https://www.iktva.sa/wp-content/uploads/2016/04/Supply\\_Chain\\_Opportunities.pdf](https://www.iktva.sa/wp-content/uploads/2016/04/Supply_Chain_Opportunities.pdf)

Companies must apply through the relevant government ministries for licenses to do business in Saudi Arabia.

## CERTIFICATION AND STANDARDS

Saudi Arabia adheres to international standards and management systems for its oil and gas industry. Employees are recommended to have the NEBOSH International Technical Certificate in Oil and Gas Operational Safety<sup>150</sup>.

## WORKING IN SAUDI ARABIA

Engineering, procurement and contracting (EPC) contracts are arranged through Saudi Aramco. To be able to bid for EPC contracts, a company must be certified as an "in-Kingdom" contractor. This involves signing a joint venture agreement with a local company and opening an office inside Saudi Arabia.

<https://esr.aramco.com/esr/component/main>

Market Strengths:

- Growing diversification within Saudi economy
- Massive government investment in transport, infrastructure, healthcare, education and energy
- Common use of English in business
- No taxation on personal income
- Proximity to other Gulf markets
- Key member of the Gulf Cooperation Council (GCC)
- Largest economy and population in the Gulf region

Market Challenges:

- Identifying suitable sponsors for initial entry into the market

<sup>150</sup> <https://www.nebosh.org.uk>

- Finding an appropriate Saudi partner for joint ventures
- Lead time to establish legal entities and obtain licenses from appropriate ministries
- Negotiating payment terms
- Adhering to Islamic laws and culture
- Legal judgments are not binding

It is illegal in Saudi Arabia to have two passports in your possession; if found, the second passport will be retained by Saudi authorities. Canadians must be in possession of a visa to visit Saudi Arabia. Workers must obtain the visa before arrival in Saudi Arabia at one of the agencies authorized by the Royal Embassy of Saudi Arabia in Ottawa or, if residing in a foreign country, at the nearest embassy or consulate of Saudi Arabia. Expect heavy penalties if you overstay the duration of your visa. Visa applications must be sponsored by a Saudi citizen, company or organization. Upon arrival, you will be required to surrender your passport to your sponsor and obtain a residency card (IQAMA).

Workers must produce a HIV test certificate, proof of a polio vaccination and a criminal background check. Female workers must be met by their sponsors at the port of arrival or risk being denied entry. To leave the country, women must seek their sponsor's (as well as their husband's) permission.<sup>151</sup>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Dammam is Saudi Arabia's member of the World Energy City Partnership.

Saudi Aramco plans to invest at least US\$140 billion in oil, gas and petrochemical projects over the next five to six years. Investment will be directed towards new gas and oil plants, and

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<sup>151</sup> <https://travel.gc.ca/destinations/saudi-arabia>

new facilities enabling the continued development of petrochemical production.

Best Prospects:

- New technologies for efficient clean fuel production
- Casing, pipes, pipe fitting, valves
- Power generation equipment
- Drilling chemicals
- Pumps
- Heat exchangers
- Gas compressors
- Tower coolers
- Instruments and controls
- Anti-corrosion systems, laboratory equipment
- Marine equipment services offshore platforms, filtration systems
- Injection equipment and services
- Production equipment and services
- Well control systems
- Packing, seals, gaskets, bearings
- Wire rope and chain
- Safety and environmental protection services
- Pollution and spill control services
- Flexible pipe
- Valves and actuators

## **Deepwater Experience**

Saudi Aramco plans to exploit natural gas reserves off the Red Sea coast. This will involve use of deep water technologies for drilling below 1,000 metres. US\$25 billion capital expenditure is expected. This project could present opportunities for Nova Scotian companies.

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

The slump in oil revenues had forced the Saudi government to draw down on more than US\$100bn of its reserves. Because of this strain, the government plans to conduct many of its future infrastructure projects through

partnerships with private, both domestic and international, companies. The country is seeking US\$50bn of investment in solar and wind energy, while also creating plans for the country's first nuclear power stations. First rounds of projects will be announced in April 2017.<sup>152</sup>

### MAJOR COMPANIES

Saudi Aramco  
Al-Khafji Joint Operations  
Saudi Arabian Chevron Inc  
Saudi Basic Industries Corporation - SABIC  
Arabian American Oil Company  
Arabian Oil Co. - Khafji  
BP International Limited  
Conoco Arabia Inc  
Exxon Saudi Arabia Inc  
International Co For Petroleum Waste  
Shell Companies In Saudi Arabia

### RENEWABLE INDUSTRY

Saudi Arabia is launching a renewable energy program in April 2017 that is expected to involve investment of between US\$30 billion and US\$50 billion by 2023. The first round of bidding for projects under the program would produce 10 gigawatts of power for the country.

Power demand in Saudi Arabia is growing by 8% annually, forcing state-run Saudi Electricity, the Gulf's largest utility company, to spend billions of dollars on projects to add capacity.

To provide a sustainable and efficient energy future for the kingdom, K.A.CARE has recommended a sustainable energy mix. In its evaluation, K.A.CARE has concluded that hydrocarbons will remain a prime element in the likely energy mix in 2032, and recommends supporting it with nuclear, solar, wind, waste-to-energy, and geothermal.

In this scenario, nuclear, geothermal and waste-to-energy will provide the base load up to night-time demand during winter; photovoltaic energy will meet total daytime demand year round; concentrated solar power, with storage, will meet the maximum demand difference between photovoltaic and base load technologies; and hydrocarbons will meet the remaining demand.<sup>153</sup>

In April 2017, Saudi Aramco has signed memorandums of understanding with Abu Dhabi National Oil Co. (ADNOC) and Masdar, Abu Dhabi's renewable energy company. The agreement with ADNOC involves identifying technologies that could deliver improved operational performance and efficiency across the oil and natural gas value chain. The deal with Masdar seeks advancements in clean electricity generation and carbon capture.<sup>154</sup>

### Waste-to-Energy

Presently, a considerable proportion of all solid waste in Saudi Arabia is placed in landfill sites. Waste-to-energy plants are a concept being considered by K.A.CARE in order to reduce landfill and the inter-related problem of ground and air pollution. K.A.CARE is therefore recommending the generation of 3GW of electricity from wastes by 2032.

<sup>152</sup><http://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=1594031>

<sup>153</sup><https://www.kacare.gov.sa/en/FutureEnergy/Pages/vision.aspx>  
<sup>154</sup> Oil & Gas Journal [www.ogi.com](http://www.ogi.com)

## Wind Power

It is likely that wind turbines will be installed along the coasts of the Red Sea and the Arabian Gulf. It is recommended the turbines generate 9GW of electricity by 2032 which will be used primarily for seawater desalination and the conversion of brackish water to potable water. Wind in Saudi Arabia is unpredictable; therefore wind energy will be used in combination with other renewable energy sources.

In January 2017, Saudi Aramco commissioned an onshore wind farm at the Turaif oil storage depot. The wind turbine is a GE Energy 2.75-120 (power 2 750 kW, diameter 120 m).<sup>155</sup>

## Geothermal

Volcanic activity is limited but is sufficient for utilization of geothermal plants alongside other energy sources.

K.A.CARE will seek to work with stakeholders in Saudi Arabia, so other opportunities will arise that will make the sector increasingly economically viable. The target installed capacity for geothermal energy is 1GW by 2032.

## Solar Power

The kingdom has one of the highest insolation rates in the world. Implementation of clean, cost-effective solar energy technologies with the aim of helping meet peak demands will generate a total of 41GW by 2032. Under consideration are two forms of solar energy – Photovoltaic (PV) and Concentrated Solar Power (CSP).

## Nuclear Energy

In addition to the renewable program, government officials from the capital city, Riyadh, are in the early stages of feasibility and

<sup>155</sup> [http://www.thewindpower.net/windfarm\\_en\\_24085\\_turaif-oil-storage-depot.php](http://www.thewindpower.net/windfarm_en_24085_turaif-oil-storage-depot.php)

design studies for its first two commercial nuclear reactors, which will total 2.8 gigawatts.

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Saudi Arabia will invite international and domestic companies to bid for renewable energy projects in April 2017. International firms are anxiously awaiting this opportunity. Nova Scotia companies that miss the deadline for submissions may have a chance by subcontracting to one of the awarded suppliers.<sup>156</sup>

Companies with experience in solar power have the best advantage in this market, but it's also the most competitive. Emerging subsectors may be more attractive to Nova Scotia companies.

Best Prospects:

- K.A.CARE will work in partnership with stakeholders to undertake research and development, create inter-related national industries, and educate and train Saudi nationals in the technology, skills and expertise of wind energy and turbines.
- Nova Scotia companies with geothermal energy may have a good prospect working in Saudi Arabia. As well, the province could learn from the country's waste-to-energy program and implement these technologies in Canada and globally.

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

K.A.CARE states that it will pursue transparent and open market policies to make bidders

<sup>156</sup> <http://fortune.com/2017/02/02/saudi-arabia-renewable-energy-bid/>

comfortable with the process and to ensure competitive pricing. Foreign companies should be aware that 60% of all inputs for nuclear energy developments and 80% of solar-related activities will be sourced locally.<sup>157</sup>

ERCA (the body responsible for the regulation of the electricity and water desalination industry in Saudi Arabia) is currently working on developing a National Renewable Energy Policy.

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## **FUNDING INCENTIVES**

EDC has financing with the Saudi Arabian Mining Company (Ma'aden) to purchase goods and services from Canadian suppliers.

There is no funding listed for SMEs in renewable energy grants.

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## **OTHER SOURCES OF INFORMATION**

US Government EIA Country Analysis Brief – Saudi Arabia  
<https://www.eia.gov/beta/international/>

US Commercial Service  
<https://www.export.gov/article?id=Saudi-Arabia-oil-gas-machinery>

King Abdullah City for Atomic and Renewable Energy 2017  
[www.kacare.gov.sa/en/Pages/default.aspx](http://www.kacare.gov.sa/en/Pages/default.aspx)

UK Government Doing Business in Saudi Arabia  
<https://www.gov.uk/government/publications/exporting-to-saudi-arabia/doing-business-in-saudi-arabia-saudi-arabia-trade-and-export-guide>

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<sup>157</sup><https://www.kacare.gov.sa/en/FutureEnergy/Pages/vision.aspx>

Offshore Technology – Saudi Arabia  
<http://www.offshore-technology.com>

## **NOTES:**

# SOUTH AFRICA



## Country Facts

Nominal GDP	314.59 Billion USD
Population	54.49 Million
Total Trade/GDP	62.45%
Currency	South African Rand (ZAR)
Merchandise Imports from Canada	621.13 Million CAD
Canadian direct investment	3,202 million CAD
Main imports	Petrol Products, Machinery & Equipment, Auto & Light Motor-vehicles

Figure 35 Source: EDC

## SOUTH AFRICA COUNTRY PROFILE

### OVERVIEW

South Africa's energy sector is critical to its economy, relying heavily on the coal mining industry. On top of coal, shale gas extraction is on the horizon and is bringing hope to propel the energy industry in South Africa. Exploration activities are scheduled to commence in 2017. South Africa has the world's 5<sup>th</sup> largest reserves, estimated at 485 trillion cubic feet (Tcf).<sup>158</sup>

South Africa is a secondary market for the large oil firms, yet many over the last few years have been showing more interest in the market. The country has a sophisticated yet small synthetic fuels industry, producing gasoline and diesel fuels.

After 2008, the South African Government

started to introduce renewable energies on a large scale and enhanced the promotion of energy efficiency in all sectors to meet the demand of energy while reducing CO<sub>2</sub> emissions.

### COUNTRY SOURCES OF ENERGY

The country generates 93% of its electricity from coal; as a result, South Africa is one of the 15<sup>th</sup> largest emitters of CO<sub>2</sub> worldwide. Other sources of electricity production are from nuclear, gas, and hydropower. Eskom is its nationally run company and supplies roughly 95% of South Africa's electricity. The remainder of power comes from independent power producers (IPPs) and imports. South Africa's nominal installed electricity capacity is about 45,645 megawatts.<sup>159</sup>

<sup>158</sup> <http://www.shalegas.international/2016/03/14/south-africa-to-see-shale-exploration-in-the-next-12-months/>

<sup>159</sup> South Africa Ministry of Energy

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

South Africa consumes the second-largest amount of petroleum in Africa, behind Egypt. The petroleum consumed in South Africa comes mostly from its domestic refineries that import crude oil and its CTL (coal-to-liquid) and GTL (gas-to-liquid) plants. South Africa imports crude oil mostly from OPEC countries in the Middle East and West Africa.

In 2015, the country had severe shortages in electricity which resulted in load shedding in various parts of the country. In order to address these challenges, the government adopted the "Five Point Plan". The Plan consists of supply-side options to encourage Eskom to improve the availability and reliability of the power stations, while increasing power capacity through Independent Power Producers (IPPs). Through the IPP Program, renewable energy, coal, gas and cogeneration has progressed significantly against the target of 17 000 MW by the end of 2022. The government hopes to improve their energy mix to 30% clean energy by 2025.<sup>160</sup>

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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South Africa has proved crude oil reserves of 15 million barrels. The reserves are located on the offshore of southern South Africa in the Bredasdorp Basin and off the west coast of the country near the maritime border with Namibia.

South Africa's petroleum and other liquids (total oil) production was about 160,000 bbl/d in 2014. Synthetic fuels, derived from coal and natural gas, accounted for more than 90% of the country's domestic petroleum supply. Less than

5,000 bb/d of crude oil and lease condensate is produced at the Oribi and Oryz fields. The country's crude oil and lease condensate production continues to decline as oil fields mature and as there has not been any commercially viable discoveries.

South Africa's offshore Orange Basin near Namibia is believed to hold substantial oil and gas resources, although there has been limited exploration activity in the area. In 2009, Shell acquired exploration rights over a large block in the basin. However, Shell's exploration activities are still in the early stages, and the company is years away from potentially exploiting any commercial reserves.

Major companies in South Africa's upstream sector are dominated by the state-owned company Petroleum Oil and Gas Corporation of South Africa (PetroSA). Downstream is more diversified and includes IOCs such as BP, Shell, Chevron, Total, and Engen. PetroSA operates all upstream oil and natural gas producing assets in South Africa, along with the GTL plant at Mossel Bay. The company also participates in oil and gas activities internationally.

South African private company, Sasol, operates Secunda, one of the world's largest coal-based synthetic fuels plant. The company holds majority interest in the 88,000 barrels per day (bbl/d) at the Natref refinery. Sasol is also involved in coal mining and marketing of natural gas and oil products. Sasol has operations around the world, including GTL projects in Nigeria and Uzbekistan. Sasol is also considering developing a GTL plant in Alberta, Canada.

### **Coal**

South Africa has the world's 9<sup>th</sup> largest amount of recoverable coal reserves and holds 95% of

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<sup>160</sup> South Africa Ministry of Energy Annual Report 2015/2016

Africa's total coal reserves. Environmental groups continue to target the industry for air, land, and water pollution. However, coal consumption in South Africa is expected to continue to increase as new coal-fired power stations are scheduled to come online to meet rising demand for electricity.

### **Coal-to-liquids (CTL)**

South Africa produces synthetic fuels from low-grade coal and a small amount from natural gas. At the Sasol synfuels plant in Secunda, more than 37 MMst of coal each year are converted into liquid fuels and a range of chemical feedstock. Sasol plans to expand Secunda's capacity. CTL synthetic fuels will be used to meet growing domestic demand for petroleum products.

### **Natural Gas**

In 2013, South Africa produced 41 billion cubic feet (Bcf) of dry natural gas and consumed 173 Bcf. The difference of 132 Bcf was imported from Mozambique via pipeline. South Africa has very limited proved natural gas reserves. Most of South Africa's natural gas is produced from the maturing offshore F-A field and South Coast Complex fields and are then sent to the GTL facility in Mossel Bay via an offshore pipeline.

### **Gas-to-liquids (GTL)**

The GTL plant at Mossel Bay is one of the largest in the world. PetroSA operates the plant, in addition to the offshore gas fields that provide the fuel. The plant has the capacity to process 45,000 bbl/d of liquid fuels through a Fischer-Tropsch Process in which natural gas is converted to synthetic liquid fuels; of which more than half is unleaded petrol (motor gasoline). The remainder includes: kerosene (paraffin), diesel, propane, liquid oxygen and

nitrogen, distillates, eco-fuels, process oils, and alcohols.

### **Petroleum and other liquids**

South Africa has small amounts of proved crude oil reserves, and the country's crude oil production is very small. Synthetic fuels, derived from coal and natural gas, account for more than 90% of the country's domestic petroleum production.

### **Shale Gas**

It is estimated that the Karoo shale gas resources would mean South Africa has the 5<sup>th</sup> largest reserves, estimated at 485 trillion cubic feet (Tcf). A study commissioned by Shell said extracting 50 trillion cubic feet or 12.8% of potential reserves, would add US\$20 billion or 0.5% of GDP to the South African economy every year for 25 years and create 700,000 jobs.

So far, Royal Dutch Shell, Falcon Oil & Gas and Bundu Gas & Oil are among five companies which have applied for exploration licenses under Karoo. Sasol has also been eyeing the country's shale reserves. Although the company has not held a licence within the Karoo region since the Technical Co-operation Permit expired in 2011, it now views Karoo's shale resources with renewed interest.

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## **PROJECTS**

- Statoil has completed a farm-in deal by acquiring a 35% interest in the ER 12/3/154 Tugela South Exploration Right from ExxonMobil Exploration and Production South Africa. Operator ExxonMobil holds a 40% interest in Tugela, with the remaining 25% held by co-venturer Impact Africa. Located offshore eastern South Africa in water depths up to 1,800m, the Tugela South



Exploration Right is spread over an area of 9,054km<sup>2</sup>.

- ExxonMobil Exploration and Production South Africa plans to begin drilling activities offshore of Durban after signing an agreement with Impact Africa. The exploration and production affiliate of ExxonMobil has agreed with the African arm of Impact Oil & Gas to acquire a 75% stake in the Tugela South Exploration Right, on the east coast of the country.
- South Africa's state-owned oil company PetroSA and Cairn India group have signed a farm-in agreement for crude oil and natural gas exploration in the Orange Basin, off the west coast of South Africa. Under the agreement, Cairn India, through its wholly-owned South African subsidiary, will hold a 60% interest in offshore block one, while the remaining 40% stake will be retained by PetroSA.

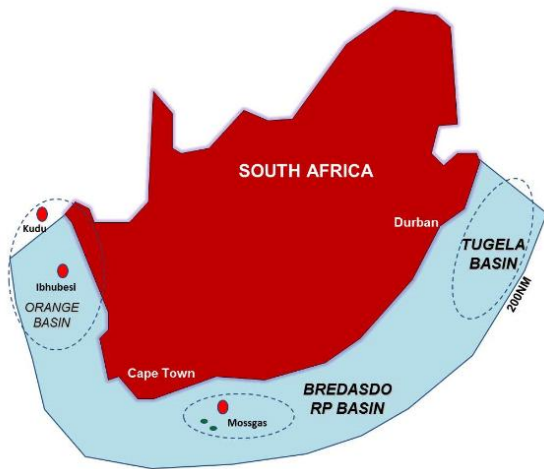


Figure 2 Oil and Gas Offshore Map Source: SAOGA

## GOVERNMENT REGULATIONS AND POLICIES

There is no definition of 'local content', however the regulations fall under the Broad Based Black

Economic Empowerment Act<sup>161</sup> and the Charter for the South African Petroleum and Liquid Fuels Industry on Empowering Historically Disadvantaged Person (HDSA). Under the Liquid Fuels Charter, all licences for petroleum exploration and production have been subject to a minimum 9% HRDA. The proportion of project companies that must be owned by disadvantaged groups under South Africa's Black Economic Empowerment policy. The level is currently being proposed to increase to 26 percent.

South Africa's Mining and Petroleum Resource Development Act (MPRDA), sets fiscal terms for resource projects in the country. Proposed amendments include switching the government's interest to a 10% lifetime carry, which would give it a stake in resource project revenues without having to pay a share of its costs. The state, meanwhile, would have the authority to declare resources 'strategic' at its discretion, potentially opening these assets to price controls and export limits.<sup>162</sup>

## CERTIFICATION AND STANDARDS

South Africa adheres to international standards and management systems for its oil and gas industry. Many companies in South Africa currently fly employees to the United Kingdom to be certified in Opito standards. The training is not offered in South Africa but is required for international work. Therefore, there is a need to harmonize global standards and local requirements for South Africa to become

<sup>161</sup> <http://www.southafrica.doingbusinessguide.co.uk/the-guide/broad-based-black-economic-empowerment/>

<sup>162</sup> <http://www.offshore-technology.com/features/featureoffshore-south-africa-taking-a-second-look-4184032/>

competitive in the offshore oil and gas industry.<sup>163</sup>

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## WORKING IN SOUTH AFRICA

Market Strengths:

- Large supply of natural resources
- Established and modern infrastructure
- Developed financial and legal services
- Fast growing middle class

Market Challenges:

- High unemployment
- Skills and capacity shortages
- Infrastructure improvements needed for energy, transport and water
- Adhering to the Broad-based Black Economic Empowerment (B-BBEE) legislation
- Offshore geological data incomplete or out of date
- Deepwater inexperience

Canadian workers must apply for the relevant visas prior to arrival; otherwise, you risk being refused entry and may be returned to your point of origin. You cannot change the type of visa once in South Africa. Your passport must contain at least two empty visa pages for the necessary South African Temporary Residence Permit, or you will be denied entry into the country. You may also be denied boarding at the point of departure if you don't have enough blank pages for the visa. If you plan to visit neighbouring countries and return to South Africa, ensure that there are sufficient visa pages in your passport for those countries' visas or you will be denied re-entry into South Africa.<sup>164</sup>

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<sup>163</sup> CENTRE FOR POLICY AND REGULATION SAMSA  
<https://www.samsa.org.za>

<sup>164</sup> <https://travel.gc.ca/destinations/south-africa>

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Cape Town is the newest member of the World Energy Cities Partnership.

Over the last few years, interest from oil and gas majors has been steadily picking up with a wave of offshore exploration deals rising.

For shale gas, South Africa has a serious shortage of the high-level skills that would be required to launch the industry. Strategies need to be set in place to develop skills to ensure sustainable development of the shale gas business.<sup>165</sup>

Best Prospects:

- Geophysical mapping
- Offshore data collection and analysis
- Deepwater consulting and services
- Shale gas consulting and services
- Opito certification training

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## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

South Africa is embarking on diversifying its primary energy sources to include shale gas. Prolonged low oil prices could starve major oil developers involved in the project of adequate cash and consequently, affect any existing time schedule for the project.<sup>166</sup>

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<sup>165</sup> <https://www.businesslive.co.za/rdm/politics/2016-11-11-is-south-africa-ready-for-the-shale-gas-revolution/>

<sup>166</sup> International Association for Energy Economics Current Drop in Oil Prices: Impact on Africa

## MAJOR COMPANIES

BP Southern Africa (Pty) Ltd  
Chevron South Africa (Pty)  
Ltd Engen Petroleum Ltd  
PetroSA (Pty) Ltd  
Sasol Oil (Pty) Ltd  
Shell South Africa (Pty) Ltd  
Total South Africa (Pty) Ltd  
ExxonMobil  
Statoil

For a full listing of companies:

<https://www.saoga.org.za/directory>

## RENEWABLE INDUSTRY

South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) has approved 79 renewable energy projects by independent power producers. The cost of wind and solar technology has decreased by over 70% over the course of four rounds of bidding, to the point where it is now competitive with coal and gas.<sup>167</sup>

South Africa is garnering lots of attention in the renewable energy industry as well. However, there are several barriers for the country, mainly the integration of renewable energies into the transmission grid, the local government acceptance towards embedded generation of solar roof-top photovoltaic installations and a significant need for technical skills.<sup>168</sup>

<sup>167</sup> IRENA

<sup>168</sup> [https://energypedia.info/wiki/South\\_Africa\\_Energy\\_Situation](https://energypedia.info/wiki/South_Africa_Energy_Situation)

South Africa's electricity demand has been exceeding the available supply. The need for affordable renewable and clean energy has accelerated interest in the viability of Small Scale Embedded Generation (SSEG) in the country. SSEG refers to power generation under 1MW/1000kW and is located on residential, commercial or industrial sites where electricity is consumed on site, excessive power flows into the municipal grid. Power supply is mostly generated through solar panels. The municipalities are promoting SSEG permits to help boost the local economies.<sup>169</sup> SSEG is promoted by the non-profit association, Green Cape.

## Hydropower

In South Africa there are 1086 large dams in operation: 846 embankments and 240 concrete dams. The total water storage of all dams is about 31.6 km<sup>3</sup>, which is about 65% of the mean annual runoff of South African rivers.

## Solar Energy

South Africa averages more than 2,500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5kWh/m<sup>2</sup> in one day. The annual 24-hour global solar radiation average is about 220 W/m<sup>2</sup> for South Africa.

Solar energy projects have been funded by African Development Bank, Agence Française de Développement, Clean Technology Fund (CTF), KfW and the World Bank. Teyma, SolAfrica, TSK Electrónica y Electricidad, Acciona, Sener and Crowie are prominent businesses operating in South Africa's solar industry.

<sup>169</sup> <http://www.green-cape.co.za>

## Biomass

South Africa has tremendous biofuel potential as the country produces about 18 million tonnes of agricultural and forestry residues every year. The only real activity has been US\$437 million investment by the South Africa's Industrial Development Corporation (IDC) and the Energy Development Corporation (EDC) in two biofuels projects that will collectively produce 190 million litres of bioethanol from sugarcane and sugarbeet.<sup>170</sup>

## Wind Power

In South Africa, wind power is now about 40% cheaper than new coal power produced by the national utility. The growth in procured capacity rose from 10 MW to 3.3 GW in just four years.<sup>171</sup>

South Africa has a geographically dispersed wind energy system, with 29 wind farms and 400 wind turbines creating electricity. There are wind turbine manufacturers outside of Cape Town owned by DCD and Gestamp Renewable Industries from Spain. Another is Palmtree Power. Operators are Eskom Generating Division, Exxaro and RedCap Kouga.

For a full list of companies:

<http://www.sawea.org.za/index.php/members/company-members>



Figure 36 Wind Farm Map Source: The Wind Power

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

The South African government states they need to build about 40,000 megawatts of new generation capacity to meet demand requirements and 17,800 megawatts should be provided by renewable energies.

The country plans to install 8,400 megawatts of wind energy, 8,400 megawatts of solar photovoltaic energy and 1,000 megawatts of concentrated solar power by 2030.

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## GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES

The National Treasury (NT) and the Department of Energy (DoE) have joined forces to establish the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP or REI4P) is the major driver of installing green power generation capacity in South Africa. It not only focuses on delivering sustainable power to

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<sup>170</sup><https://cleantechsolutions.wordpress.com/2011/12/27/biomass-energy-in-south-africa/>

<sup>171</sup> <http://www.sawea.org.za/>

the grid, but also at creating jobs and fostering local development.<sup>172</sup>

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## FUNDING INCENTIVES

International Financial Institutions (IFIs) play a leading role in funding for projects in South Africa. Funding may be available from the African Business Development Bank, World Bank and the Clean Technology Fund.

Nova Scotia companies should contact their Global Affairs Canada representative for assistance with working with international financial institutions (IFI's).  
<https://www.afdb.org/en/countries/southern-africa/south-africa/>

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## OTHER SOURCES OF INFORMATION

US Government EIA Country Analysis Brief – South Africa  
<https://www.eia.gov/beta/international/>

UK Government Doing Business in South Africa  
<https://www.gov.uk/government/publications/>

Offshore Technology – South Africa  
<http://www.offshore-technology.com>

Sonal Sejpal, Njeri Wagacha and Sheila Nyayieka (Anjarwalla & Khanna, Kenya, ALN),  
A Review of Local Content Regulations in the Upstream Oil & Gas Sector in Africa  
<http://www.kwm.com/en/uk/knowledge/insights/a-review-of-local-content-regulations-in-the-upstream-oil-and-gas-sector-in-africa-20160101>

Chris Lo, Offshore South Africa: taking a second look, 2014, <http://www.offshore->

[technology.com/features/featureoffshore-south-africa-taking-a-second-look-4184032/](http://www.offshore-technology.com/features/featureoffshore-south-africa-taking-a-second-look-4184032/)

South African Oil and Gas Alliance  
<https://www.saoga.org.za/oil-gas-hubs/upstream-oil-gas-south-africa>

## NOTES:

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<sup>172</sup>[https://energypedia.info/wiki/South\\_Africa\\_Energy\\_Situation](https://energypedia.info/wiki/South_Africa_Energy_Situation)

# UNITED KINGDOM



## Country Facts

Nominal GDP	2,850.10 Billion USD
Population	64.44 Million
Total Trade/GDP	56.84%
Currency	British Pound (GBP)
Merchandise Imports from Canada	15,951.81 Million CAD
Canadian direct investment	92,935 Million CAD
Main imports	Machinery & Equipment, Chemicals, Mineral Fuels, Food, Beverage & Tobacco

## UK COUNTRY PROFILE

### OVERVIEW

The United Kingdom (UK) is the 2<sup>nd</sup> largest producer of oil in Europe, after Norway. And, it is the 3<sup>rd</sup> largest producer of gas, after Norway and the Netherlands. This industry is important to the UK economy, contributing .8% to its gross domestic product (GDP) and providing 330,000 jobs.<sup>173</sup> In global terms, the UK is the world's 5<sup>th</sup> largest economy in terms of GDP.

The country has been operating in the offshore oil and gas industry for over 50 years. Their storied experience has availed the UK as a world leader in operations, research, and supply and services in oil and gas, marine and the renewable energy industries.

The decline in oil prices greatly affected the UK energy industry. Large companies consolidated

<sup>173</sup><http://researchbriefings.parliament.uk/ResearchBriefing/Summary/CBP-7268#fullreport>

Figure 37 Source: EDC

operations, local firms had to diversify and there were significant job losses. Analysts now believe that with recent investments and growth in production, there is a new confidence brewing in the industry.

The UK's £9 billion subsea sector is a global leader in terms of experience, innovation and technology. The sector employs over 50,000 employees across around 700 companies across a range of subsea industries including oil and gas, marine renewables, primary offshore wind and emerging sectors wave and tidal.

### COUNTRY SOURCES OF ENERGY

In 2015, the National Infrastructure Commission reported the country generates its energy from a variety of sources. The majority was gas at 29%,

coal (18%), wind (12%), nuclear (9%) then under 6% of wind, solar and others.<sup>174</sup>

The UK had 85 gigawatts (GW) of installed electricity generation capacity at the end of 2014. Capacity has fallen since 2010 as several fossil fuel-fired plants and a few nuclear reactors have shut down.

The UK remained a net importer of electricity in 2015, with net imports contributing 5.8% of the electricity supply.

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## **CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'**

In 2014, petroleum and natural gas accounted for 36% and 33%, respectively, of total energy consumption. Coal also continues to be a significant part of total energy consumption. The UK has however seen a decline in consumption resulting from economic contraction and improvements in energy efficiency.

To address falling exploration activity, the UK Government invested £40 million in 2015 and 2016. The government is working with other European countries to further develop the North Sea. A total of 38 crude and natural gas projects are scheduled to start production in the North Sea by 2025, the UK will be responsible for 27 projects (Norway 10 and Denmark 1).<sup>175</sup>

The government is aware of the country's increasing reliance on imported fuels, and has developed key energy policies to address the domestic production declines. These policies include: using enhanced recovery from current and maturing oil and natural gas fields, promoting energy efficiency, decreasing the use

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<sup>174</sup> National Infrastructure Commission "Smart Power" 2016

<sup>175</sup> [http://www.offshore-](http://www.offshore-technology.com/researchreports/researchreportreport-norway-and-uk-to-lead-in-planned-oil-and-gas-production-in-the-north-sea-by-2025-5747465/)

[technology.com/researchreports/researchreportreport-norway-and-uk-to-lead-in-planned-oil-and-gas-production-in-the-north-sea-by-2025-5747465/](http://www.offshore-technology.com/researchreports/researchreportreport-norway-and-uk-to-lead-in-planned-oil-and-gas-production-in-the-north-sea-by-2025-5747465/)

of fossil fuels (and thus reliance on imports), promoting and energy trade cooperation with Norway. The government plans to grow its renewable energy industry to reduce green house gas emissions. To decarbonize, the UK needs large investments in energy infrastructure.<sup>176</sup>

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## **ENERGY INDUSTRY**

### **OIL AND GAS**

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The North Sea has become the centre of one of the world's most productive energy industries. Eight of the biggest oil fields in the North Sea are on the Norwegian continental shelf with the remaining two perched on the UK shelf. Clair oil field, the biggest oil field in the North Sea and Europe, is also the biggest hydrocarbon resource on the UK Continental Shelf (UKCS). The second is the the Forties oil field, east of Aberdeen in the UK license block 21/10. It was discovered in 1970 and started production in 1975.

Nexen is the largest field operator in the UK in terms of oil production. As of the end of 2015, Nexen operated eight fields, which combined produced about 187,000 bpd in 2014. Nexen operated fields accounted for about 24% of total UK production in 2014. The UK's largest producing field in 2014 was the Nexen operated Buzzard oil field, which produced an average of slightly more than 154,000 b/d. The Buzzard field reached full capacity of 200,000 b/d in 2008, then production consistently declined. Nexen did extensive maintenance of the field which caused outages. Reliability at the field was better in 2015, and production about 168,000 b/d.

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<sup>176</sup> Review of the UK oilfield services industry January 2017

As with Buzzard, the UK's petroleum and other liquids production last peaked in 1999. The production decline slowed in 2014 as production fell year-over-year by only 1% to average 900,000 barrels per day (b/d). In 2015, production increased by 10% to average one million b/d. Much of this increase is attributable to new fields brought online in 2014 and 2015.

There are long lead times to develop fields in the North Sea; therefore production from a new field occurs several years after the decision to develop that field had been made and when crude oil prices would have been higher. These long term challenges could threaten future production potential from new and smaller fields, while the UK's existing fields are being maximized. Ernst and Young (EY) reports the West of Shetland has the greatest potential to expand production, with over one billion boe reserves in development. In addition, the Central North Sea (CNS) remains an active area for exploration, not least with high pressure, high temperature prospects, and the Hebridean basin remains relatively.

The 2016 theme in the UK's North Sea was "consolidation" as companies looked to accelerate the rate of technological innovation in the sector. In April 2016, Schlumberger Limited announced its merger with Cameron International Corporation. The merger will create technology-driven growth by integrating Schlumberger's reservoir and well technology with Cameron wellhead and surface equipment, flow control and processing technology that the companies believe will result in the industry's first complete drilling and production system.

Next, in May 2016, Technip and FMC Technologies Inc. announced they will merge to become TechnipFMC, with the aim of creating a global leader that will drive change by redefining

the production and transformation of oil and gas.

Halliburton and Baker Hughes announced the termination of the proposed \$28bn merger in May 2016, citing opposition from US and European antitrust regulators. In March 2017 it was announced that Wood Group were to acquire rival Amec Foster Wheeler in a £2.2bn all-share takeover. Aberdeen based Wood Group aims to become the global leader in project engineering and technical services across a range of sectors including oil and gas and renewables.

As stated, a number of new fields came on-stream in 2016 including the Alder field off the Scottish coast. Chevron advised more than 70% of the budget was invested in subsea expertise in new technology to develop the field.

The Scolty/Crathes development achieved first oil in November 2016. This was the only offshore pure oil FDP approval in the UK North Sea in 2015. Unit operating costs are expected to be under \$15/bbl in the initial peak volume years and production is anticipated to continue until 2025.<sup>177</sup>

The Cygnus field delivered first gas in December 2016. This field is expected to support approximately 5,000 jobs during its five-year development period, with over 80% of the contract work being secured by UK companies due to the world-class capabilities of the UK OFS supply chain.

The UK Government has pledged to fund research and development to catapult the North Sea in becoming leaders in global innovation. An additional £2 billion a year has been committed

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<sup>177</sup> <http://news.cision.com/enquest-plc/r/scolty-crathes-first-oil,c2127113>



in research and development by 2020-21. The Aberdeen Oil & Gas Technology Centre opened February 2017. The Centre aims to be the 'go to' global centre for solving offshore mature basin, subsea and decommissioning technology challenges, and to make the north-east a focal point for oil and gas technology. The Centre will help companies develop and deploy new products and processes to reduce costs.

The UK also has an onshore industry. There are now 120 onshore oil and gas sites with 250 operating wells producing between 20,000 and 25,000 barrels of oil equivalent a day.<sup>178</sup>

### **Decommissioning**

Over the next decade, more than 100 oil and gas platforms are earmarked for complete or partial removal from the UK Continental Shelf (UKCS) and the Norwegian Continental Shelf (NCS). Offshore oil and gas decommissioning in the UKCS will be close to US\$20 billion over the next five years.

However, many companies are delaying decommissioning activities due to cash-flow constraints. Others companies are deferring ending production and are trying to improve efficiency and extending the field life. EY reports some of the cost of decommissioning can be offset against previous taxes paid, yet many operators with end-of-life assets either do not currently have the financial capacity to undertake decommissioning activity or are simply choosing to focus on running as leanly as possible, even if it is at a loss.

### **Natural Gas**

The UK's natural gas production and consumption have been on a long-term declining trend; however in recent years both

have been flat or have increased modestly. UK natural gas production peaked in 2000, and consumption peaked in 2004. Since then, natural gas production and consumption have both generally been declining. The UK holds an estimated 7.3 trillion cubic feet (Tcf) of proved natural gas reserves as of January 2016. Most of the UK's natural gas production comes from offshore liquids fields, accounting for 55% of total gross natural gas production in 2014. Natural gas from offshore dry gas fields accounted for almost 45% of production in 2014, and onshore fields accounted for less than 1% of total gross natural gas production.

### **Shale Gas**

Shale testing is still at an early phase in the UK, and compared with North America, the shale geology of the UK is considerably more complex. The two formations that have received the most attention so far are the Bowland shales, and the Weald basin in southern England. The Bowland shales are more likely to hold natural gas, and the Weald is more likely to hold liquid hydrocarbons.

### **Coal**

Coal production in the UK is declining as a result of falling consumption from environmental regulations, relatively cheap natural gas that competes with coal for power generation, and a surge of low cost coal imports. Coal consumption in 2014 was 53 MMst, almost 80% of which was used in the electric sector.

In 1956 the UK enacted the Clean Air Act after the great London smog of 1952. The Clean Air Act prohibits the emission of dark smoke from industrial buildings, private homes, and railroad locomotives.

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<sup>178</sup> <http://www.ukogplc.com/page.php?pid=72>

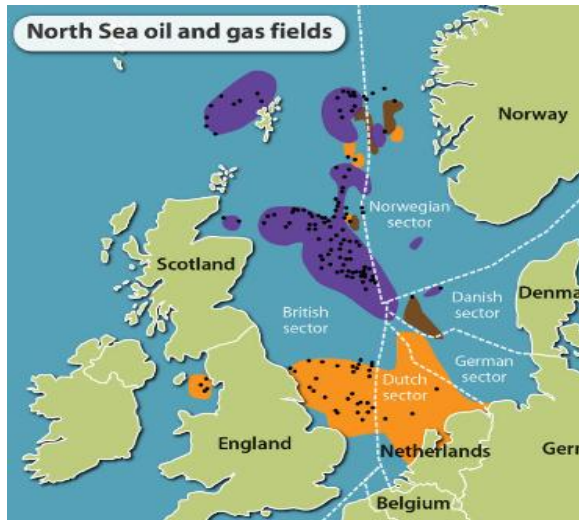
## Nuclear

Currently accounting for just below one-fifth of total electricity generation, nuclear power plants are central to the UK government plans for future electricity generation. There were 15 operating nuclear reactors in the UK at the end of 2014, with a current capacity of slightly less than 9 gigawatt electric (GWe), according to the World Nuclear Association. All 15 operating reactors are owned and operated by EDF Energy, a subsidiary of Électricité de France. Most of the existing nuclear capacity started operations in the 1970s or 1980s and are due to be shut down by 2023.

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## PROJECTS

- UK Oil & Gas Investments (UKOG) has announced that its subsidiary UKOG Solent has been granted a one-year extension to the initial term for its offshore P1916 licence by the Oil and Gas Authority.
- Faroe Petroleum has announced the start the Boné exploration well 7318/12-1 in the western part of Norwegian Barents Sea. The company has also decided to drill an appraisal well on the Brasse discovery.
- Total has awarded a contract to Prosafe for the provision of the Safe Caledonia semi-submersible accommodation vessel at the Elgin-Franklin facility in the UK North Sea. This contract is meant for 134 days and includes an extension option for an additional 30 days. On-site operation is expected to commence in May 2017. Valued at US\$10m, the contract includes mobilisation, demobilisation and associated services.
- Veolia has been contracted to decommission and recycle offshore oil platforms after the end of their operational life at Great Yarmouth, UK, in partnership with Peterson. After completion of their operational life, the offshore platforms will be brought to an area 40 miles off the coast of Great Yarmouth for decommissioning. The facility is scheduled to receive the first platforms for decommissioning in the next few months.
- China National Offshore Oil Corporation's Nexen Petroleum is assessing the second phase of Buzzard development in the UK offshore region. The company has also planned to develop two high-pressure, high-temperature (HPHT) exploration wells in the North Sea. CNOOC now intends to proceed with an infill drilling campaign and subsea scheme to exploit the northern part of the North Sea field.
- Australian-based Frogtech, Geoscience Wales and Geop4ysics will complete their new interpretations and products using data acquired during last year's £20m seismic survey of the Rockall Trough and Mid-North Sea High (MNSH) areas of UK's Continental Shelf.
- Engineering firm Bilfinger has secured 210 jobs after winning a deal to carry out maintenance work on key Scottish oil and gas infrastructure for another five years from BP. The contract is for providing a range of support services at the Forties pipeline system terminals in Grangemouth and the Sullom Voe terminal in Shetland. The deal replaces a previous agreement from 2015, according to Bilfinger, whose group headquarters are in Germany.



**Figure 38 Oil and Gas Offshore Map Source: Crystal Energy**

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## GOVERNMENT REGULATIONS AND POLICIES

The UK government does not hold a direct interest in oil production, but the sector remains important to the government because of its contributions to the overall economy and to government tax revenues. Taxes on UK Continental Shelf (UKCS) production totaled about £2.2 billion in fiscal year 2014-15.

A report commissioned by the UK government in 2013 recommended adopting a strategy for Maximizing Economic Recovery (MER)<sup>179</sup> from the UKCS. The government's implementation of the report's recommendations has included decreases in the tax rates on UK oil and natural gas production in 2015 and 2016, including tax incentives for a broad range of investments. As of January 1, 2016, the new tax regime imposes marginal tax rates on profits from oil and natural gas production between 30% and 67.5%, further

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<sup>179</sup> <https://www.bonddickinson.com/insights/events/legal-content-maximising-economic-recovery-aberdeen>

lowering the maximum rate of 81% implemented under the 2011 tax changes.<sup>180</sup>

Another effect of the UK government's MER strategy was establishing the Oil and Gas Authority (OGA) on April 1, 2015. The OGA is an executive agency of the UK's Department of Energy & Climate Change (DECC) – now the Department for Business, Energy and Industrial Strategy. The OGA issues oil and natural gas licenses and collects data from license holders. The OGA has additional powers and tools beyond those of DECC, including the establishment of a dispute resolution process and the ability to attend industry meetings. The OGA has the objective to drive greater collaboration and productivity within the oil and gas industry, as well as attracting investment and creating jobs.<sup>181</sup>

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## CERTIFICATION AND STANDARDS

The United Kingdom adheres to international standards and management systems for its oil and gas industry. BOSIET, or basic offshore safety instruction and emergency training are required in the UK.<sup>182</sup>

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<sup>180</sup> <https://www.ogauthority.co.uk/>

<sup>181</sup> <http://oilandgasuk.co.uk/wp-content/uploads/2015/07/EY-Review-of-the-UK-oilfield-services-industry-January-2016-WV.pdf>

<sup>182</sup> <http://work.chron.com/certification-need-work-oil-rig-29574.html>

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## MAJOR COMPANIES

BP  
Chevron  
ExxonMobil  
TAQA  
Marathon  
Perenco UK  
Nexen  
Sumitomo Corporation  
Rowan  
Apache Corporation  
Zennor Petroleum  
Talisman Energy  
ConocoPhillips

For a full listing of companies:

<http://oilandgasuk.co.uk/members-list.cfm>

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## WORKING IN THE UK

The UK has no significant trade or investment barriers for Nova Scotia companies and no restrictions on the transfer of capital or repatriation of profits.

Market Strengths:

- Long business and cultural ties with Nova Scotia
- Ease of doing business
- Large supply of natural resources
- Well established and modern infrastructure
- Well developed financial and legal services

Market Challenges:

- Mature industries with skilled workers and established companies

- Uncertainties due to the UK leaving the European Union (BREXIT). If the UK leaves, they will also be out of the CETA free trade agreement. A new agreement with the UK will have to be ratified.
- Scotland is again asking for a referendum for independence from England. Main reason is BREXIT.

Canadian workers must apply for the relevant work visas. A work permit is required even if someone is planning to do unpaid, volunteer, part-time or temporary work.

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## OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS

Aberdeen, Scotland is the member of the World Energy City Partnership and home to Offshore Europe.

Challenges for the energy industry in the UK offer opportunities for Nova Scotian companies. Challenges facing the industry include asset integrity, well construction, exploiting small pools and decommissioning.

Changing operating models and contract structures or the various forms of new digital and other technologies are also challenges for the industry. The UK recognizes the industry needs to remain relevant and continue to innovate, while maintaining rigorous cost controls. The Aberdeen Oil & Gas Technology Centre will be working with industry to address these challenges. <https://theogtc.com/>

The Oil and Gas Innovation Centre is also an excellent platform for business, connecting individual companies to work with a university on a specific project (smaller scale than OGTC) and the project usually lasts between three months and a year. <http://www.ogic.co.uk/>

#### Best Prospects:

- Digital process technologies – “end-to-end” digital solutions
- Improved safety processes
- Productivity management and cost saving controls
- Topside technology and asset performance management processes
- Acquisition management processes
- Life cycle management technologies
- Warehousing and logistics digital solutions
- Partnerships with the Aberdeen Oil & Gas Technology Centre

In the electrical industry, UK public and private organizations are investing in upgrading the grid, creating significant business opportunities for Nova Scotia companies. Target sub-sectors offering high potential for exporters include:

- Smart meters and advanced metering infrastructure
- Communication and data management software
- Grid optimization and automation technologies;
- Demand response and control systems;
- Energy management for distributed generation and storage
- Cyber security software and services
- Consumer engagement platforms and services

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## IMPACTS DUE TO THE VOLATILITY IN OIL PRICES

The volatility of high oil prices forced oil and gas companies, and their suppliers, to find ways to reduce costs, while maintaining profits.<sup>183</sup>

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<sup>183</sup> [http://www.ey.com/Publication/vwLUAssets/EY-review-of-the-UK-oilfield-services-industry-January-2017/\\$FILE/EY-Review-of-the-UK-oilfield-services-industry-January-2017.pdf](http://www.ey.com/Publication/vwLUAssets/EY-review-of-the-UK-oilfield-services-industry-January-2017/$FILE/EY-Review-of-the-UK-oilfield-services-industry-January-2017.pdf)

Companies are using any excess cash-flow for paying off debt rather than reinvesting into new projects. Companies are also collaborating on projects, financially restructuring and delaying projects such as decommissioning.

## RENEWABLE INDUSTRY

The UK’s electricity supply faces an unprecedented challenge, with around a 5<sup>th</sup> of existing generation shutting down over the next decade. Over a £100 billion investment is needed by 2020 for increasing electricity demand as the country focuses on clean energy supplies.<sup>184</sup>

### Wave and Tidal Power

The UK produces 50% of Europe’s tidal energy and 35% of its wave energy. Wave and tidal stream energy has the potential to meet up to 20% of the UK’s current electricity demand, representing a 30-to-50 gigawatt (GW) installed incrementally up to the year 2050.

New industry clusters have been created in Cornwall, the Solent and Isle of Wight, Scottish Highlands and Islands, and Wales. One commercial project, Atlantis’ Meygen in the

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<sup>184</sup> <https://www.gov.uk/guidance/onshore-wind-part-of-the-uks-energy-mix>



**Figure 39 Wave and Tidal Sites Source: Renewable UK**

Highlands, is bringing new opportunities to industry and communities. Unemployed workers from the North Sea oil and gas industry have transferred their skills and are now working in these smaller communities in tidal energy.

Another project, Wave Hub, located off of Cornwall, is the world’s largest and most technologically advanced test site for offshore renewable energy technology. New wave demonstration sites are being developed in Pembrokeshire and a tidal site in Devon.

Challenges for the industry are operational expenses. In 2017, the Energy Technologies Institute (ETI) announced that wave power devices being tested in Cornwall and at Orkney are 10 times more expensive than other sources of low carbon power. However, industry insiders disputed the analysis, saying they would not be

testing and developing the technology if they thought it was not commercially viable.<sup>185</sup>

Companies working in the wave and tidal industry are:

- AW Energy
- AquaMarine Power
- Alstom
- Atlantis Resources Corporation
- FluMill
- OpenHydro
- Scottish Power Renewables
- Seatricity
- Voith Hydro
- Nauticity Carnegie Clean Power
- GWave LLC

For a full list:

<http://renewableuk.site-ym.com/search/custom.asp?id=3933>

### Wind Power

Onshore wind energy has established itself as a mature, clean and productive technology. It is now the UK’s largest source of renewable energy generation. There are 5785 onshore turbines, 1198 operational projects with capacity of 9 gigawatts (GW).

The UK has been the world leader in offshore wind since October 2008, with more installed capacity than any other country. There are 1465 offshore wind turbines, 27 operational projects with a capacity of 5 gigawatts (GW) operating in the UK. Under existing plans, the capacity is expected to double by year 2020.<sup>186</sup>

Companies in the wind power industry include:

<sup>185</sup><https://www.theguardian.com/environment/2017/jan/16/uk-wave-power-far-too-costly-warns-energy-research-body>

<sup>186</sup><http://www.telegraph.co.uk/business/2016/06/05/renewableuk-chief-wind-industry-must-show-what-it-offers-britain/>

- Aelos Wind Energy
- Evance (UK)
- Evoco (UK)
- Gaia-Wind (Denmark and UK)
- Marlec Renewable Power (UK)
- Kingspan Environmental
- UseTheWind (UK)
- West Wind Turbines (UK from Australia)
- AGR Renewables
- Airvolution Energy
- B9 Energy
- Banks Developments
- Banks Renewables
- Beaufort Wind Limited,
- BP Alternative Energy
- Broadview Energy
- Centrica
- Cleanearth Energy

- Construction port infrastructure
- Geophysical surveys
- Environmental surveys
- Meteorological station surveys
- Array cable-laying



**Figure 40 Wind Farm Map Source: The Wind Power**

ScottishPower Renewables has chosen Nexans' submarine cables to carry energy onshore from its new 714MW East Anglia ONE offshore wind farm. Nexans will supply and install two 85km 3-core submarine cables with embedded fibre optics, as well as accompanying accessories, for the wind farm in the North Sea. The contract is worth more than €180m.<sup>187</sup>

- ROV support
- Substation/ turbine installation vessels
- Navigational aids
- New technologies for energy management
- New technologies to bring renewable energy to the electrical grid

There are local content rules in wind power. UK content of wind farm developments stands at about 30 percent.<sup>188</sup>

Opportunities may also be found in nuclear decommissioning and new-build areas.<sup>189</sup>

## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

There are many opportunities for existing technologies to serve the renewable energy market in the UK.

Best Prospects:

<sup>187</sup> [http://www.nexans.co.uk/eservice/UK-en\\_GB/navigatepub\\_149242\\_-35526/Nexans\\_HV\\_cables\\_to\\_connect\\_ScottishPower\\_Renewabl.html](http://www.nexans.co.uk/eservice/UK-en_GB/navigatepub_149242_-35526/Nexans_HV_cables_to_connect_ScottishPower_Renewabl.html)

<sup>189</sup> <http://tradecommissioner.gc.ca/united-kingdom-royaume-uni/market-facts-faits-sur-le-marche/0000978.aspx?lang=eng>

<sup>188</sup> CITEAS Review 2013

Under the Climate Action Plan, the UK new carbon target is to reduce carbon emissions 57% by 2030 based on 1990 levels. The government has outlined various industry and consumer mechanisms. Relevant strategies are the investment in low-carbon technologies. The government has pledged to reduce emissions by:

- Taking action to increase the use of low-carbon technologies and creating an industry for carbon capture and storage
- Reducing emissions from the power sector and encouraging investment in low-carbon technologies by reforming the UK's electricity market
- Providing funding incentives and programs

The Department for Business, Energy & Industrial Strategy works with UK industry, and across Government, in partnership with the Devolved Administrations to help the UK win a greater share of offshore wind business. This involves working closely with key wind turbine companies, the supply chain and regional partners such as Local Enterprise Partnerships (LEPs) and Centres for Offshore Renewable Engineering (COREs) to develop supply chain opportunities for companies able to compete on price and quality.<sup>190</sup>

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## **FUNDING INCENTIVES**

### **European Energy Innovation Funding - 2016 Horizon 2020 Energy Calls**

There are many funding opportunities for doing business in the renewable energy industry in the UK and EU. Nova Scotia companies would have to partner with a local supplier. The 2016 Calls for Proposals for Horizon 2020 Energy are now

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<sup>190</sup> <https://www.gov.uk/guidance/offshore-wind-part-of-the-uks-energy-mix>

open. Horizon 2020 Energy has a budget of around €6bn over the period 2014 – 2020.

For more information:

<https://www.gov.uk/guidance/innovation-funding-for-low-carbon-technologies-opportunities-for-bidders>

EDC has funding available to the mining company Anglo American plc in the UK for purchasing goods and services from Canadian suppliers.

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## **OTHER SOURCES OF INFORMATION**

US Government EIA Country Analysis Brief – United Kingdom

<https://www.eia.gov/beta/international/>

UK Oil & Gas Activity Survey 2016

UK Oil & Gas Economic Outlook 2017

Renewables UK

<http://www.renewableuk.com/page/WindEnergy>

Offshore Technology – UK

<http://www.offshore-technology.com>

Industrial Policy: Lessons from the North Sea N. J. Smith Civitas Review 2013

US Commercial Service

<https://www.export.gov/article?id=United-Kingdom-Smart-Grids>

Ernst & Young (EY)

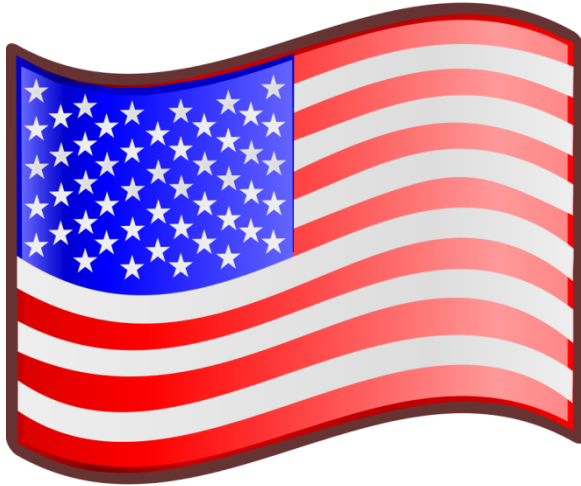
Review of the UK oilfield services industry  
January 2017

Aberdeen City Council

## **NOTES:**



# UNITED STATES OF AMERICA



## Country Facts

Nominal GDP	17,947.00 Billion USD
Population	321.34 Million
Total Trade/GDP	28.06%
Currency	US Dollar (USD)
Merchandise Imports from Canada	401,481.92 Million CAD
Canadian direct investment	448,513 Million CAD
Main imports	Consumer and Capital Goods, Industrial Supplies, Auto & Light Motor-Vehicles

## USA COUNTRY PROFILE

### OVERVIEW

The United States is the world's leading producer of oil and natural gas, as well as the leading refiner of fuels and petrochemicals.<sup>191</sup>

In April 2017, the United States produced an average of about 4,962 thousand barrels of crude oil per day, and 49,617 million cubic feet of gas per day.<sup>192</sup> The country is projected to become the world's 3<sup>rd</sup> largest LNG supplier in five years, behind Qatar and Australia, according to the International Energy Agency (IEA).<sup>193</sup>

The top 15 states, in terms of the total number of jobs directly or indirectly attributable to the

Figure 41 Source: EDC

oil and natural gas industry's operations in 2011, were Texas, California, Louisiana, Oklahoma, Pennsylvania, Florida, New York, Illinois, Ohio, Colorado, Michigan, Kansas, North Carolina, New Jersey, and Georgia. Combined, these states account for 70% of the total oil and natural gas industry jobs.<sup>194</sup> Texas leads the nation in energy production, primarily from crude oil and natural gas and the state is the country's largest wind energy producer.

The country's Clean Power Plan created by the Obama administration has been "rolled back". Despite this roll back, strategies to reduce green house gas emissions can be implemented by individual states. Nova Scotia exporters need to review renewable energy opportunities by sector, especially as it relates to employment figures. The more people the renewable energy

<sup>191</sup> <http://www.api.org/~media/Files/Policy/SOAE-2017/State-Of-American-Energy-Report-2017-High.pdf>

<sup>192</sup> <https://www.eia.gov/petroleum/drilling/#tabs-summary-2>

<sup>193</sup> <https://www.iea.org>

<sup>194</sup> [http://www.api.org/~media/Files/Policy/Jobs/Economic\\_Impacts\\_ONG\\_2011.pdf](http://www.api.org/~media/Files/Policy/Jobs/Economic_Impacts_ONG_2011.pdf)

industry employs, the more favourable the industry is federally.

This report focuses on Texas as Houston is the World Energy City.

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## COUNTRY SOURCES OF ENERGY

Petroleum, natural gas, coal, renewable energy, and nuclear electric power are primary sources of energy in the United States. The three major fossil fuels, petroleum, natural gas, and coal accounted for most of the nation's energy production in 2015; natural gas (32%), petroleum from crude oil and natural gas plant liquids (28%), coal (21%), renewable energy (11%) and nuclear electric power (8%).<sup>195</sup>

According to Bloomberg Financial, hydropower provided 80 GW of renewable capacity (excluding pumped storage), and wind and solar capacity has increased over 600% since 2007 (from 16 GW to 123 GW). Biogas, biomass, geothermal, and waste-to-energy represent 18 GW of capacity in the US.

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## CURRENT STATE OF ENERGY USE AND 'ENERGY DIRECTION'

Primary energy consumption in the United States in 2016 totaled 97.4 quadrillion British thermal units (Btu), a slight increase from the 2015 level. Fossil fuels continue to account for the bulk of US energy consumption with petroleum and natural gas as the leading fossil fuels consumed. In 2016, the country utilized less coal than in previous years.<sup>196</sup> This could change in 2018 as the country is moving toward expanding coal operations.

Moreover, the United States now produces more oil domestically than it imports from foreign

sources. This achievement confirms the country as the number one natural gas producer in the world. The natural gas sector was resilient in 2016 with the historic emergence of the US as an LNG exporter. With the rise of natural gas as a power generation fuel, LNG has overtaken coal as the leading source of electric generation for the first time on an annual basis.<sup>197</sup>

Even though global industries experienced a down turn from low crude prices, the United States had still remained a major source of growth in oil and gas exploration and development. The growth was mainly due to shale and ultra deep-water resources. For this reason, US companies have developed advanced and cost-competitive techniques for extracting hydrocarbons from shale and hard to reach offshore oil and gas deposits. These techniques allow many US producers to remain competitive in the global marketplace.

Lastly, with a growing pipeline infrastructure and access to ports, the United States is positioning themselves to be a leading global LNG exporter.

The oil and gas industry in the US does not exclusively remain in the fossil fuel sector. The industry spent \$90 billion between 2000-2014 in new technology investment to reduce greenhouse gas emissions and meet future energy needs. Domestic US oil and natural gas companies are pioneers in developing alternatives and expanding America's use of virtually every form of energy – from geothermal to wind, from solar to biofuels, from hydrogen power to the lithium ion battery for next-generation cars.<sup>198</sup>

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<sup>195</sup> EIA US Energy Information Administration

<sup>196</sup> <https://www.eia.gov/todayinenergy/detail.php?id=30652>

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<sup>197</sup> Deloitte 2017 outlook on oil and gas | My take: John England

<sup>198</sup> <http://www.api.org/State-Of-American-Energy-Report-2017>

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## ENERGY INDUSTRY

### OIL AND GAS

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The most important regions for energy resources and infrastructure for both onshore and offshore is the Gulf of Mexico. The area accounts for 17% of total crude oil production and offshore natural gas production and 5% of total US dry production. Over 45% of total US petroleum refining capacity is located along the Gulf coast, with 51% of total natural gas processing plant capacity.<sup>199</sup>

In 2016, US companies began exporting LNG for the first time from the lower-48 states. Shipments were sent to major markets in South America, Europe, the Middle East and East Africa.

According to the US Energy Information Administration – EIA, Texas is the leading state:

- Texas was the top crude oil-producing state in the nation in 2015 and exceeded production levels even from the federal offshore areas.
- As of January 2016, the 29 petroleum refineries in Texas had a capacity of over 5.4 million barrels of crude oil per day and accounted for 30% of total US refining capacity.
- Texas accounted for over 27% of US marketed natural gas production in 2015, making it the leading natural gas producer among the states.
- Texas is the nation's largest producer of lignite coal. About 40% of the coal burned for electricity generation in Texas is lignite.

Major fields in the Gulf of Mexico include Eugene Island block 330 oil field, Atlantis Oil Field, Tubular Bells, Lucius, Jack, St. Malo and the

Tiber oilfield. Notable oil platforms are Baldpate, Bullwinkle, Mad Dog, Magnolia, Mars, Petronius, and Thunder Horse.



Figure 42 Source: American Oil & Gas Historical Society

### Natural Gas – Shale

The US Department of Energy published that up to 95% of new wells drilled today are hydraulically fractured, accounting for more than 43% of total oil production and 67% of natural gas production.

EIA estimates that as of January 1, 2014, there were about 2,474 trillion cubic feet (Tcf) of technically recoverable resources of dry natural gas in the United States. At the rate of dry natural gas consumption in 2014 of about 26.6 Tcf per year, the country has natural gas reserves to last nearly 93 years.

The country's energy revitalization is driven by the enormous amount of gas resources found in inland formations, including the Eagle Ford and Barnett in Texas, the Woodford in Oklahoma, the Bakken in North Dakota and Marcellus under the states of Pennsylvania, New York, Ohio, Maryland and West Virginia.<sup>200</sup>

In the first quarter of 2017, approximately 27 companies have filed a record 130 drilling permits for new oil and gas wells in the onshore

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<sup>199</sup> [https://www.eia.gov/special/gulf\\_of\\_mexico/](https://www.eia.gov/special/gulf_of_mexico/)

<sup>200</sup> EIA, "Carbon Dioxide Emissions From Energy Consumption: Electric Power Sector," October 2016

Eagle Ford.<sup>201</sup> Among those making the biggest push in the Eagle Ford are Carrizo Oil & Gas, ConocoPhillips' subsidiary Burlington Resources, Chesapeake Energy and Marathon Oil Corp.

The Permian Basin is also experiencing a more expedient recovery. The West Texas shale now has 306 active drilling sites which have been growing every week. After combining the Eagle Ford and Permian Basin with other drilling sites, as of March 2017, Texas has a total of 386 active rigs, and the US as a whole has 754 rigs deployed.<sup>202</sup>

Employment wise, a 2013 study produced by IHS Markit<sup>203</sup> found that energy from shale and other tight-rock formations supported 2.1 million jobs in 2012, and that number was projected to increase to 3.9 million jobs by 2025, including 500,000 manufacturing jobs.

## LNG

The US is expected to become a net exporter of natural gas on an average annual basis by 2018, according to the recently released EIA Annual Energy Outlook 2017. LNG exports are expected to contribute to a growing share of natural gas exports and to surpass pipeline exports of natural gas by 2020.

The Sabine Pass facility in Louisiana became the first operating LNG export facility in the Lower 48 states in 2016. Four LNG export facilities currently under construction are expected to be completed by 2021. Combined, these five plants are expected to have an operational export capacity of 9.2 Bcfd. After 2021, projected US exports of LNG are predicted to grow at a more

modest rate as US natural gas faces growing competition from other global LNG suppliers.

US exports of natural gas by pipeline to Mexico are also expected to increase. Exports to Mexico have doubled since 2009 and are projected to continue rising through at least 2020 as pipeline projects currently under construction are completed.<sup>204</sup> The US government also recently approved the Keystone Pipeline project from Canada.

## Refineries

There were a total of 141 operable petroleum refineries in the United States as of January 1, 2016. Some notable refineries include the Petromax Refining Co which operates a 25,000 b/cd refinery in Houston and Buckeye Partners LP operates a 46,250 b/cd condensate processing facility in Corpus Christi. In 2012, Motiva upgraded its refinery in Port Arthur, Texas, making it the largest refinery in the US with a capacity of 603,000 b/cd as of January 1, 2016. In 2009, Marathon upgraded its Garyville, Louisiana refinery and as of January 1, 2016, the capacity is more than double its original 1977 capacity.

## Coal

The United States holds the world's largest estimated recoverable reserves of coal and is a net exporter of coal. The country is also developing carbon capture and sequestration technologies with the goal of capturing 90% of CO2 emissions from coal to help allow coal to remain a strategic fuel for the nation while enhancing environmental protection.<sup>205</sup>

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<sup>201</sup> <https://eaglefordshale.com/>

<sup>202</sup> <http://www.bizjournals.com/houston/news/2017/02/27/eagle-ford-permian-basin-rig-counts-up.html>

<sup>203</sup> <https://www.ihs.com/>

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<sup>204</sup> <http://www.worldoil.com/news/2017/2/24/eia-Ing-exports-expected-to-drive-growth-in-us-natural-gas-trade>

<sup>205</sup> <https://www.selectusa.gov/energy-industry-united-states>

In 2015, nearly 897 million short tons of coal were produced in 25 states. Five states produced a total of about 639 million short tons, or about 71% of total US coal production. The five largest coal producing states with production in million short tons and the share of total US coal production in 2015:

- Wyoming: 375.8 (42%)
- West Virginia: 95.6 (11%)
- Kentucky: 61.4 (7%)
- Illinois: 56.1 (6%)
- Pennsylvania: 50.0 (6%)

On March 28, 2017 US President Donald Trump signed an executive order eliminating numerous restrictions on fossil fuel production. The President declared an end to what he's called "the war on coal." The order also lifts a 14-month-old moratorium on new coal leases on federal lands. Currently, coal mining accounts for fewer than 75,000 US jobs.

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## PROJECTS

- TransCanada and its joint venture with Sempra Energy's subsidiary IEnova and Infraestructura Marina del Golfo (IMG) has secured a contract for the \$2.1bn Sur de Texas-Tuxpan offshore natural gas pipeline in Mexico. The project will link with TransCanada's Tamazunchale and Tuxpan-Tula pipelines, as well as with other transporters in the region. Construction activities for TransCanada's Tuxpan-Tula and the Tula-Villa de Reyes pipelines are already in progress and are expected to be operational in 2018.
- April 2017, Marathon Petroleum Corp. has let a contract to Fluor Corp. to provide engineering and procurement (EP) for a major reconfiguration project involving works at both the 459,000-b/d Galveston Bay and 86,000-b/d Texas City refineries in Texas City, Texas.

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## MAJOR COMPANIES

Anadarko  
 Chevron Corp.  
 Sempra Energy  
 Plains All American Pipeline LP  
 Occidental Petroleum Corp.  
 Noble Energy Inc.  
 Hess Corp.  
 Chesapeake Energy Corp.  
 Baker Hughes Inc.  
 Atmos Energy Corp.  
 Halliburton Co  
 Phillips 66 Co.  
 Sysco Corp.  
 Schlumberger Ltd.  
 ConocoPhillips  
 Enterprise Products Partners LP  
 Rowan Companies  
 Nabors Industries Ltd  
 EOG Resources  
 Marathon Corporation  
 Hilcorp Energy Co.,  
 Killam Oil  
 Occidental Petroleum Corp.  
 Fluor

To access more local companies: Petroleum  
 Equipment & Services Association  
<http://www.pesa.org/>

- April 2017, Kinder Morgan Texas Pipeline LLC (KMTP), a subsidiary of Kinder Morgan Inc., and DCP Midstream LP have signed a letter of intent for DCP to participate in the development of the proposed Gulf Coast Express pipeline project that will connect Permian basin

gas production with the Texas Gulf Coast. The project is designed to transport up to 1.7 million dekatherms/day of gas through 430 miles of 42-in. pipeline from the Waha, Tex., area to Agua Dulce, Tex. The pipeline is expected to be in service in second-half 2019, subject to shipper commitments.

- March 2017, offshore energy companies paid more than \$315 million in bids to lease 913,542 acres in the Gulf of Mexico off the coast of Louisiana, Mississippi and Alabama. The lease sale is the final one in the GOM under the Obama Administration's Five-Year Plan, which made available all offshore areas with the greatest resource potential from 2012 through 2017. The first 11 sales in the program netted more than \$3 billion in bid revenue on almost 73 million acres for development, according to information from the Interior Department. The top five bidders included major oil and gas companies: Shell Offshore – \$61 million, Statoil – \$51 million, Chevron Corp. – \$50 million, Hess Corp. – \$44 million and ExxonMobil – \$22 million.
- February 2017, Royal Dutch Shell has given the go-ahead to develop its Kaikias deepwater field in the Gulf of Mexico, the first such project the oil and gas company has approved in 18 months.
- In 2016, Australia's Otto Energy Ltd. announced that it has been advised by Operator, Byron Energy Inc., a subsidiary of Byron Energy Limited (Byron), that the SM-71 #1 well located at the South Marsh Island Block 71 in the Gulf of Mexico has completed drilling to the final target measured depth at 6,843 feet (2,086 meters) or 6,477 feet (1,974 meters) True Vertical Depth.
- In 2016, Royal Dutch Shell's recent Fort Sumter discovery provides further indication that running room still exists in Shell's heartlands acreage in the deepwater US Gulf of Mexico. Fort Sumter is estimated to hold recoverable resources of over 125 million barrels of oil equivalent (boe). That size could increase following the results of further appraisal drilling and planned wells in adjacent structures.
- Stone Energy Corp. is again producing oil and natural gas from the Pompano platform in the Gulf of Mexico. Production from the platform was shut down following a June 28 explosion at Enterprise Products Partners LP's gas processing plant in Pascagoula, Miss. Stone didn't have a direct interest in the plant, but the facility processed approximately 20 million cubic feet per day (MMcf/d) to 25 MMcf/d gross gas from Pompano.
- Enterprise Products Partners LP (EPP) plans to build a 571-mile pipeline to transport natural gas liquids from the Permian basin to the firm's NGL fractionation and storage complex in Mont Belvieu, Texas. The Shin Oak NGL pipeline will originate at EPP's Hobbs NGL fractionation and storage facility in Gaines County, Tex. The 24-in. OD pipeline will have an initial design capacity of 250,000 b/d, expandable to 600,000 b/d. The project is supported by long-term customer commitments and is expected to be in service in second-quarter 2019.
- Noble Energy Inc. is ramping up production from its Gunflint oil development in the deepwater Gulf of Mexico. The company expects gross production from Gunflint of at least 20,000 barrels of oil equivalent per day (boepd); 75 % of that production is expected to be oil. Noble expects a net amount to its interest of at least 5,000 boepd.
- BP Plc is seeking to extend the production life of one of its biggest operated deepwater US Gulf of Mexico

fields with a major water injection project. The company will seek to boost oil and gas recovery from one of the Thunder Horse field's three main reservoirs. The water injection project is part of BP's strategy of continued investment in its existing deepwater Gulf of Mexico production hubs.

- BP PLC reached a final investment decision on the long-delayed Mad Dog Phase 2 offshore oil platform in the Gulf of Mexico — the company wants to go ahead with the project. The platform originally was meant to start producing in 2018, but the partners on the project decided in 2013 to reexamine the design after it proved to be too costly and complex. The latest iteration of the project now is expected to cost \$9 billion and have up to 140,000 barrels per day of production capacity.
- Houston-based Enterprise Products Partners LP announced two projects centered around the Houston-area's midstream ethylene infrastructure. The first is a modification to one of its existing storage facilities. The second project is a new, 12-inch diameter pipeline to carry ethylene from Mont Belvieu to Bayport, connecting to Enterprise's ethane export terminal at Morgan's Point.
- Chevron Phillips Chemical has announced a \$5 billion project to build an ethane cracker at its Cedar Bayou plant in Baytown, as well as two polyethylene units in Old Ocean, in Brazoria County.
- Lyondell Basell Industries NV is building a \$700 million polyethylene plant in La Porte on the south shore of the Houston Ship Channel. Construction is scheduled to start early next year and is slated to wrap up around 2019. It's expected to create up to 1,000 construction jobs and 75 permanent jobs.
- A joint venture between Irving, Texas-based Exxon Mobil Corp. and Saudi

Basic Industries Corp. has proposed a \$10 billion ethane steam cracker near Corpus Christi, Texas.

- Houston-based CenterPoint Energy, one of Houston's biggest public companies, wants to plug into the burgeoning petrochemical industry around Freeport. CenterPoint Energy has submitted a proposal to the Electric Reliability Council of Texas to spend \$250 million on electric transmission infrastructure projects to feed growing power demands in the Gulf Coast town south of Houston. The company offers electric transmission, natural gas distribution and energy services operations to multiple states around the US.
- The South Texas town of Agua Dulce has already become a major hub for natural gas pipelines but with companies looking to ship more shale gas to Mexico, a new construction boom is about to get underway.
- Houston-based Halliburton Co. plans to have hired more than 2,000 US oil field workers by the end of the first quarter 2017. The hiring is in support of a sharp increase in demand for oil field services as the upstream sector builds momentum on what many assume is the end of the persistent oil downturn. Halliburton secured work from an independent oil company at five deepwater rigs, and the company's second-quarter revenues should increase over those of the first quarter.
- Houston-based Cheniere Energy Inc. has gathered the agreements from potential shippers it needs to support taking the next steps on its Midship Pipeline project. The 200-mile-long Midship Pipeline would draw natural gas out of production areas in the SCOOP and STACK plays in Oklahoma and into US Gulf Coast markets, according to a Cheniere press release. Right now, it's expected maximum capacity would be 1.4 million dekatherms per day.

- Irving, Texas-based ExxonMobil Corp. will continue with a series of 11 projects on the US Gulf Coast that it expects to have created more than 45,000 jobs over the life of the project. The projects started in 2013, and will continue through 2022. The projects stretch across the chemical, refining, lubricant and liquefied natural gas markets. They will take place at existing and new proposed facilities along the coastlines of Texas and Louisiana, and the exports are largely targeted at Asian markets.
- France-based energy giant Total S.A. is purchasing around 23% of Tellurian Investments Inc. at \$5.85 a share, a total of \$207 million, to develop an integrated gas project. Tellurian has an 800-acre site in Louisiana on the Calcasieu River where it intends to build an LNG liquefaction plant dubbed Driftwood LNG to export LNG overseas. Tellurian has contracted with Bechtel to provide the engineering, procurement and construction of the facilities and Chart Industries will develop the liquefaction technology. Construction is expected to begin in 2018, and the project should become operational in 2022.
- Trelleborg Offshore US Inc. has added a new team in Houston to its engineering division, and it plans to double the size of the team by the end of next year. The new global riser analysis team of mathematicians and consultants currently has four employees, all based in Houston, and Trelleborg Offshore will look to double that by the end of 2017.
- Houston's Rowan Companies PLC and Saudi Arabian Oil Co., better known as Saudi Aramco, plan to create a 50-50 joint venture to own, operate and manage offshore drilling rigs in Saudi Arabia. The new company is expected to launch in the second quarter 2017.
- Solaris Oilfield Infrastructure, a Houston-based logistics company, expects to hire as it ramps its business back up during

the tail end of the oil downturn. The company has already started hiring logistics support personnel in Houston. Solaris will incrementally add three or four more over the course of next year. The company is also adding employees in other functions around its Early, Texas, manufacturing plant.

- Houston-based Baker Hughes Inc. plans to build a new hydraulic fracturing and cementing services company in North America. The new company is expected to operate under the BJ Services brand and to have its headquarters in Tomball. Baker Hughes, along with CSL Capital Management and Goldman Sachs fund West Street Energy Partners, are backing the firm.
- Statoil Inc. will spend \$2.5 million to renew its agreement with the University of Texas at Austin in support of graduate student research on geology, geophysics and petroleum engineering.
- Citadel Casing Solutions, a new Houston-based manufacturer, has received its initial investment and launched operations. Denver-based Aspen Energy Partners provided the multimillion-dollar equity commitment. Citadel, which was founded in July by former employees of Houston-based Halliburton Co. manufactures casing equipment and accessories that support well construction and wellbore integrity.
- Hilcorp Alaska, LLC plans to invest \$31 million in 2017 on maintenance and infrastructure on aging pipelines in Cook Inlet.

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## **GOVERNMENT REGULATIONS AND POLICIES**

The US Government does not have a national energy policy. However, the oil and gas industry can be affected by state government energy and environmental policies. The US has both federal and individual state agencies that regulate certain aspects of oil and gas production.



Individual states also have not established a comprehensive energy policy to manage their energy resources. For example, domestic onshore oil and gas development is regulated by the individual states under mandates to prevent waste and protect human health and the environment, while encouraging the greatest ultimate use of domestic oil and gas production. Whereas, oil and gas production occurring offshore in the Gulf of Mexico is managed by various US Federal Government agencies to ensure safe and environmentally responsible development. The federal government is responsible for the payment of production royalties and taxes for the public benefit. The Department of the Interior regulates the extraction of oil and gas from federal lands. The Bureau of Land Management regulates oil development, exploration and production on federal onshore properties. The Office of Natural Resources Revenue collects royalties owed to the government for onshore and offshore production.

The government's right to economic benefits is generally similar to that of individuals; it is the subject of contract, not law. This is a unique feature of the US system and is unlike that of other countries, where the government can gain an economic benefit, for example, tariffs on production.

In those instances where a US local, state or federal government entity is the owner of the oil and/or gas rights, and leases those rights for development, the lease conveying the rights to an operator will include a production royalty payable to the property owner entity. Local, state and federal government entities can therefore derive direct economic benefits from the ownership and development of the oil and gas estates through specific and general taxes,

as well as royalties derived from production on government-owned lands.<sup>206</sup>

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## **CERTIFICATION AND STANDARDS**

Offshore workers are required to have:

- BOSIET (Basic Offshore Safety Induction and Emergency Training)
- STCW 95 (Standards of Training, Certification and Watchkeeping) is designed for anyone on vessels of over 200 tons going beyond territorial waters
- HUET (Helicopter Underwater Escape Training)

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## **WORKING IN THE USA**

Nova Scotia workers can enter USA through the NAFTA agreement. Companies should review that proper paperwork is in order for repair and installation workers as well as company transfers.

Market Strengths:

- Strong ties between Canada the United States
- North American Free Trade Agreement
- Proximity to the market
- Low regulatory barriers
- No language barriers
- Access to global supply chain, which can lead to exports for other markets
- A strong rule of law
- Canadian dollar is attractive to importers from the US

Market Challenges:

- The US is not a single national market; it is a federal system. You must treat each state as a separate entity
- High litigation. Nova Scotians should employ legal firms with a US office and

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<sup>206</sup> <http://ca.practicallaw.com/9-525-1545?source=relatedcontent>

ensure they have insurance coverage in the US

- Highly competitive market from other international suppliers. Products and services need to have a competitive advantage and companies need to be able to market this advantage
- Staying on top of any upcoming changes to NAFTA
- Buy American policies and protectionism sentiment
- The US is outpacing Canada in natural gas and LNG development, Nova Scotians would need to ensure they are up-to-date in all technological developments

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Houston is the member city of the World Energy City Partnership. Houston is the country's main center for the energy industry and host to many energy conferences including the Offshore Technology Conference.

With the growing natural gas industry, the United States is a large importer of oil & gas field equipment and pipes. With about \$12 billion in imports in 2013, the United States was the largest importer of oil & gas equipment, purchasing about 9% of all global oil & gas equipment sold worldwide.

Best Prospects:

- Infrastructure construction, equipment and supplies for oil and natural gas pipelines, new and repair of aging pipelines
- Environmental services and remediation, subsea pipeline inspection for leaking pipelines in Alaska
- Front End Engineering Design (FEED)
- Upstream oil field services
- Efficient technologies in shale gas extraction

- Environmental remediation new technologies shale gas extraction
- New technologies and services in ultra-deep water exploration

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## **IMPACTS DUE TO THE VOLATILITY IN OIL PRICES**

The Energy Policy and Conservation Act of 1975 banned the export of crude oil produced from the US. Limited exceptions were granted by the Department of Commerce, resulting in between 50,000,000 and 100,000,000 barrels being exported annually. On December 18<sup>th</sup>, 2015, amid the historic downturn in global oil prices, the US Congress lifted the crude oil ban, allowing US oil producers to sell in global oil markets.

Energy economically dependent states such as Texas experienced a downturn in the economy with bankruptcies, layoffs and company mergers. For example, in 2015 oilfield service providers Baker Hughes Inc and Halliburton Co cut thousands of jobs as drilling activity slowed due to a steep fall in crude oil prices. In April 2016, Maersk Oil has announced plans to close its Houston office in the US and reduce the Luanda team due to weak market conditions for deepwater developments. ConocoPhillips, the largest US independent oil producer, plans to sell up to \$8 billion in natural gas assets and trim its capital budget by 4% in 2018 to provide funds to bolster operations.

However, other parts of the country benefited from low oil prices. Energy prices fell faster in the US than in other countries. With natural gas half as expensive in the US than Europe and Asia, low energy prices were a competitive advantage to almost all American companies. Additionally, low oil prices were doubly felt in the US because the country still imports hundreds of billions of dollars of oil a year.

Currently, employment in the US is getting back on track due to the ramp-up in onshore activity with shale. Many E&P (exploration and production) and oil service companies are now searching for talent again after being left with an almost-depleted workforce due to the industry downturn.<sup>207</sup>

## RENEWABLE INDUSTRY

The United States is home to a thriving renewable energy industry with strengths in the wind, solar, geothermal, hydropower, biomass, and biofuels sectors. The country produces more geothermal energy than any other country (2,640MW); more biomass power than any other country (15,407 MW); enjoys the 2<sup>nd</sup> largest wind industry (73,751 MW); the 3<sup>rd</sup> largest hydropower industry (79,298 MW); and the 4<sup>th</sup> largest solar industry (27,810 MW). The International Renewable Energy Agency (IRENA) projects that by 2030, the share of renewables in the total US energy mix could reach 27 percent. This would mean an increase from 134 GW of renewable energy in 2010 to over 700 GW in just two decades. The United States also had the 2<sup>nd</sup> highest investment in the world in 2015, with nearly 16GW of new renewable energy capacity and \$91 billion in clean energy transactions, according to Bloomberg New Energy Finance.<sup>208</sup>

Renewable fuels also had the largest increase in energy consumption. Considerable electric generating capacity was added for both wind and solar resources in 2016. Wind generation increased by nearly 20%, making up almost half of all renewable consumption increases. Hydroelectric consumption increased by 7% as

<sup>207</sup> [http://www.rigzone.com/news/oil\\_gas/a/149141/us\\_jobs\\_report\\_oil\\_gas\\_employment\\_increases\\_in\\_march](http://www.rigzone.com/news/oil_gas/a/149141/us_jobs_report_oil_gas_employment_increases_in_march)

<sup>208</sup> <https://www.selectusa.gov/energy-industry-united-states>

the West Coast recovered from severe drought conditions. Together, wind, hydro, and solar made up 91% of renewable consumption increases. Biomass consumption, which accounted for 47% of all renewable consumption in 2016, remained close to its 2015 level.<sup>209</sup>

Employment wise, renewable energy including wind, solar and biofuels as of the end of 2016 accounted for more than 650,000 US jobs.<sup>210</sup>

### Smart Grid

The United States is an international leader in the development and deployment of smart grid technologies and services. Its subsector is defined by the electric grid equipment and services required for the modernization of distribution and transmission systems, and ICT. This sector is gaining a renewed focus on investment due to reliability enhancement, connecting to renewables, demand shifts, cost increases, and market reforms that create more options for independent generators and as such require new connections to transmission systems.<sup>211</sup>

### Nuclear

As of December 1, 2016, there were 99 operating nuclear reactors at 61 nuclear power plants in the United States. The R. E. Ginna Nuclear Power Plant in New York is the smallest nuclear plant in the United States, and it has one reactor with an electricity generating capacity at 508 megawatts (MW). The Palo Verde nuclear power plant in Arizona has three reactors and has the largest combined electricity generating capacity of about 3,937 MW.

<sup>209</sup> EIA

<sup>210</sup> US Department of Energy

<sup>211</sup> <https://www.selectusa.gov/energy-industry-united-states>

## Hydropower

The majority of the nation's renewable electricity is generated by hydropower. The United States is the 4<sup>th</sup> largest producer of hydroelectricity in the world after China, Canada and Brazil. The country has 2,200 hydropower plants providing with 100,000 MW of hydropower capacity.

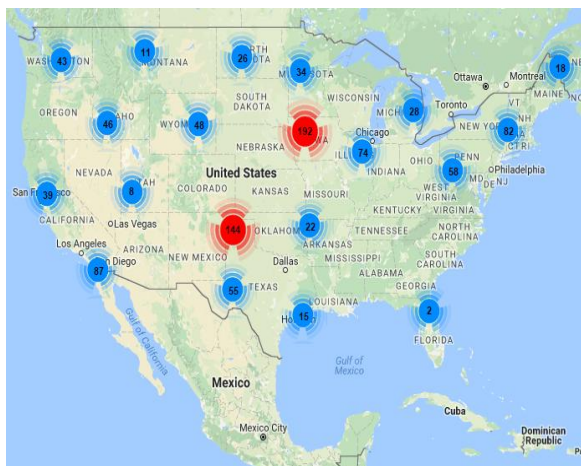
The Grand Coulee Dam in Washington State is the 5<sup>th</sup> largest hydroelectric power station in the world. Moreover, hydro is generating power in every region of the country and accounts for 52% of the nation's renewable electricity generation and 7% of total electricity generation.

America's hydropower industry has the potential to create more than 1.4 million cumulative jobs by 2025. The industry's supply chain consists of more than 2,500 companies which employs approximately 300,000 people.

For a listing of member companies of the National Hydropower Association:

<http://anf5l2g5jfk16p6te3ljwwpk.wpengine.netdna-cdn.com/wp-content/uploads/2017/01/NHA-Members-12.16-1.pdf>

## Wind Power



**Figure 43 Wind Farm Map Source: The Wind Power**

The United States has 1,205 wind farms producing 106.0 GW supplying 4% of the nation's electricity.

The United State's offshore wind resource has the potential to contribute up to four times the generating capacity of the current US electrical system. The US Department of Energy report, "20% Wind Energy by 2030", found that offshore wind capacity could provide 22 gigawatts (GW) of the 300 GW needed to deliver 20% of the nation's electricity by 2030. There are more than 500 wind manufacturing facilities spread across 43 states producing the more than 8,000 components that comprise a typical wind turbine.<sup>212</sup>

Top manufacturers are GE Renewable Energy, Vestas, Siemens, Alstom, Enron, Zond, Tacke, NEG Micon, Micon, Nordtank, NedWind, Wind World, Bonus, Gamesa, Mitsubishi, Suzlon, Clipper, Acciona Windpower, Servion, and Nordex.

Wind energy market actors/utility companies include 5045 Wind Partners, AES, Alaska Village, Electric Coop, American Electric Power, Apex Wind Energy, ArcLight Capital Partners, Atlantic Renewable Energy, Babcock & Brown, Basin Electric Power Cooperative and Black Hills Energy.

Texas leads the nation in wind-powered generation capacity with more than 18,500 megawatts. In 2014 and 2015, Texas wind turbines produced more electricity than the state's two nuclear plants.<sup>213</sup> The state is followed by Iowa and California in wind energy production.

<sup>212</sup><http://www.awea.org/manufacturing>

<sup>213</sup><https://www.eia.gov/state/?sid=TX>

Massachusetts is creating a new offshore wind farm; call for bids are expected in June 2017. The first solicitation of the 1,600 MW mandated in state legislation could be anywhere from 200 MW to 800 MW. The draft RFP will be submitted to the Massachusetts Department of Public Utilities (DPU) and be available as a public document via the DPU. The state expects three developers to compete in the solicitation — DONG Energy, Deepwater Wind and Vineyard Wind — with the winner entering into a power purchase agreement by the middle of next year.<sup>214</sup>

Maryland is also ramping up its wind energy industry and state officials refer to offshore wind as the ‘Space Race.’ The state is positioning itself to become the supply chain hub for the offshore wind sector. Maryland is strategically located at the heart of the mid-Atlantic and its Port of Baltimore is one of America’s busiest international deep-water ports, now equipped with supersized Panamax cargo cranes and 50-foot-deep channels. The state government recently announced two new grant programs to help prepare Maryland’s local businesses entering the offshore wind industry and to help prepare Maryland’s labor force.<sup>215</sup>

### **Geothermal Energy**

Geothermal power plants are largely concentrated in the western states. They are the 4<sup>th</sup> largest source of renewable electricity, after hydroelectricity, biomass, and wind power. A geothermal resource assessment shows that nine western states together have the potential

to provide over 20% of national electricity needs.<sup>216</sup>

The largest group of geothermal power plants in the world is located at The Geysers, a geothermal field in California. The United States generates an average of 15 billion kilowatt hours of geothermal power per year, comparable to burning some 25 million barrels (4,000,000 m<sup>3</sup>) of oil or 6 million short tons of coal per year.

### **Tidal Energy**

Ocean Renewable Power Company (ORPC) is developing power from the Bay of Fundy in Maine. The project, the Western Passage Tidal Energy, will feature 15 double TidGen TGU hydrokinetic tidal devices, each consisting of a 500kW turbine-generator unit. The project is said to produce an average annual power generation of 2.6 to 3.5GWh.<sup>217</sup>

In another area of the country, the US Department of Energy announced in December 2016 the award of up to \$40 million (subject to appropriations) to design, permit, and construct an open-water, grid-connected national wave energy testing facility. The facility will be constructed in Newport, Oregon, by the Northwest National Marine Renewable Energy Center at Oregon State University and will support innovations in wave energy technologies capable of harnessing the significant wave energy resources along United States coastlines.<sup>218</sup>

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<sup>214</sup> <http://www.renewableenergyworld.com>

<sup>215</sup> <http://news.maryland.gov/mea/2017/04/20/maryland-energy-administration-director-tung-declares-offshore-wind-is-marylands-space-race/>

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<sup>216</sup> [https://en.wikipedia.org/wiki/Geothermal\\_energy\\_in\\_the\\_United\\_States](https://en.wikipedia.org/wiki/Geothermal_energy_in_the_United_States)

<sup>217</sup> <http://tidalenergytoday.com/2017/01/05/orpc-shows-progress-on-maine-tidal-project/>

<sup>218</sup> <https://energy.gov/articles/energy-department-announces-investment-wave-energy-test-facility>

## Biomass

In 2015, approximately 4.7 quadrillion British thermal units of energy derived from biomass were consumed in the United States. US biomass energy production is expected to grow to 5.6 quadrillion British thermal units in 2040. Net electricity generation of wood and wood-derived fuels came to a little under 42 gigawatt hours in 2015, making it the 2<sup>nd</sup> largest non-hydroelectric renewable energy source after wind.<sup>219</sup>

## Biofuels

In 2015, US biofuel production grew to about 31 million metric tons of oil equivalent, up from about three million metric tons in 2000.

The United States is the world's largest producer of ethanol, having produced nearly 15 billion gallons in 2015 alone.<sup>220</sup> Most gasoline in the US contains 10% ethanol by volume. However, if the Renewable Fuel Standard (RFS) requirements continue to be implemented, the US could exceed this level of ethanol in the fuel mix.<sup>221</sup> The US attributes ethanol to transforming the nation from depending on imports to a refined petroleum products net exporter.<sup>222</sup>

One new project to note is the US technology company, D3MAX, has announced that its cellulosic ethanol technology is helping ACE Ethanol to produce higher yields from corn fiber. Installed at ACE Ethanol, LLC, in Stanley, Wisconsin, the testing of the patented D3MAX corn fiber-to-ethanol process and technology is

underway with testing to be complete by June of 2017.<sup>223</sup>

## Solar Power

In terms of total installed capacity, by year end 2015 the USA ranked 4<sup>th</sup> in the world behind China, Germany, and Japan. In 2016, 39% of all new electricity generation capacity in the country came from solar, more than any other source and ahead of natural gas (29%).<sup>224</sup> As of the end of 2016, the US had 40 gigawatts (GW) of installed photovoltaic capacity, having almost doubled in capacity from the previous year. In the 12 months through January 2017, utility scale solar power generated 35.5 terawatt-hours (TWh), 0.92% of total US electricity.

Furthermore, the US has some of the largest solar farms in the world. California has traditionally dominated the US solar market with 35% market share in 2016. The state's biggest farm is Solar Star, a 579 megawatt farm near Rosamond, California. Other markets are continuing to expand, including Massachusetts, Utah, and New York. According to the US Solar Industry Association, future growth in the industry will take place in Texas.

Nearly 260,000 Americans work in solar in more than 9,000 companies throughout the country. By 2021, employment is set to grow to more than 360,000.<sup>225</sup>

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<sup>219</sup> <https://www.statista.com/topics/1000/biomass-energy/>

<sup>220</sup> <http://www.afdc.energy.gov/>

<sup>221</sup> <http://www.api.org/news-policy-and-issues/fuels-and-renewable-policy>

<sup>222</sup> <http://biofuels-news.com>

[display\\_news/12164/londonbased\\_investment\\_firm\\_may\\_invest\\_E160m\\_in\\_danish\\_secondgeneration\\_bioethanol\\_project/](http://display_news/12164/londonbased_investment_firm_may_invest_E160m_in_danish_secondgeneration_bioethanol_project/)

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<sup>223</sup> <http://biofuels-news.com>

<sup>224</sup> US Solar Market Grows 95% in 2016, Smashes Records, Greentech Media, Mike Munsell, February 15, 2017

<sup>225</sup> <http://www.seia.org/research-resources/solar-industry-data>

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## **OPPORTUNITIES FOR NOVA SCOTIA EXPORTERS**

Best Prospects:

- Tidal and wave energy technology transfer with Maine and other parts of coastal US, as the country is investing millions in new wave energy technologies
- Collaboration projects with the Northwest National Marine Renewable Energy Center at Oregon State University
- Construction and design services polyethylene plants
- Subcontract opportunities in Massachusetts wind energy project

New hydropower projects are rumored, and President Trump has publically stated that he is a supporter of hydropower. A legislative hearing held the second week of April 2017 by the US House Committee on Natural Resources' Subcommittee on Water, Power and Oceans could open some Bureau of Reclamation facilities for non-federal pumped storage development. If approved, the official House Resolution would stimulate non-federal pumped storage hydropower development in the 17 western states.<sup>226</sup>

Nova Scotia companies would have to follow any new announcements to come. The hydropower industry hires project developers, construction companies, architecture, engineering firms, electricians, component manufacturers and biologists.

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<sup>226</sup><http://www.renewableenergyworld.com/articles/2017/04/proposal-could-open-reclamation-facilities-for-non-federal-pumped-storage-development.html>

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## **GOVERNMENT POLICIES/REGULATIONS THAT ENCOURAGE SUSTAINABLE TECHNOLOGIES**

The Clean Power Plan (CPP) was unveiled by President Obama and the EPA in 2016. The purpose of the plan was to reduce greenhouse gas emissions by 32% from 2005 levels by 2030. This goal would have been accomplished through a combination of new renewable generation and a shift away from fossil fuels, particularly coal. Sixteen states opposed the plan and the new Trump Administration signed the "Energy Independence Executive Order" to roll back the CPP and the removal of greenhouse gas emissions from permitting review under the National Environmental Policy Act and the removal of a moratorium on new coal leases on federal lands.<sup>227</sup>

Nonetheless, federal tax credits for solar and wind has probably been the single biggest pieces of policy favoring renewables. The policies have received extensions but are also slated to be ramped down, and there is some risk that that reduction schedule may be accelerated under the Trump administration.<sup>228</sup>

In driving the sustainable energy transition, state policies will be crucial. For example, the Renewable Portfolio Standards (RPS) has been a key tool in driving the wind and solar build. States also use Energy Efficiency Resource Standards (EERS) to encourage energy savings, and determine net energy metering policies. This policy is important for distributed solar. As well, the 2017-Sustainable-Energy-in-America-Factbook by Bloomberg New Energy Finance,

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<sup>227</sup> <http://www.hydroworld.com/articles/2017/03/breaking-trump-signs-executive-order-rolling-back-clean-power-plan.html>

<sup>228</sup> <http://money.usnews.com/investing/articles/2016-12-23/solar-wind-investments-in-a-trump-presidency>

reported a number of states made sweeping changes to these policies. Some of these include:

- Massachusetts set a mandate for 1.6GW of offshore wind by 2027, along with a requirement that the state's utilities procure 9.45TWh of clean energy through long-term contracts and an authorization for the state to set a storage target. Meanwhile, the state Supreme Court ruled that Massachusetts has not taken enough action on greenhouse gas emissions. In response, the state's Republican governor has proposed to raise the RPS target to 80% by 2050 and limit emissions from the transportation sector for the first time, among other recommendations.
- New York, where the state's "Reforming the Energy Vision" progressed with the adoption of a new Clean Energy Standard which formalizes a renewable energy generation target of 50% by 2030, as well as a zero-emissions credit program to support three of the state's struggling nuclear facilities. Additionally, Westchester Smart Power became the state's first Community Choice Aggregation (CCA) program, following the Public Service Commission's 2015 order authorizing CCAs, and the state approved \$40m of financing for feasibility studies on micro-grid resiliency projects.
- California state law SB-32, which was passed in 2016, requires statewide greenhouse gas emissions to be 40% below the 1990 level by 2030. This law has cross-cutting effects in California, particularly on electricity and transportation emissions, and also has national implications because of the size of California's energy market.

## RENEWABLE ENERGY REQUIREMENTS AND INCENTIVES

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Federal, state, and local governments and electric utilities encourage investing in and using renewable energy, and in some cases, require it. Many programs and incentives are currently available. The [Database of State Incentives for Renewable Energy and Efficiency \(DSIRE\)](http://www.dsireusa.org/) is a comprehensive source for information about the types and status of government and utility requirements and incentives for renewable energy.<sup>229</sup>

<http://www.dsireusa.org/>

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## FUNDING INCENTIVES

The North American Free Trade Agreement (NAFTA) with the USA gives Canadians a benefit for exporting goods and services.

The following companies have access to EDC funding to buy Canadian goods and services:

- Alon Energy USA, Inc.
- AT&T Inc.
- Baker Hughes Incorporated
- Chesapeake Oilfield Operating, L.L.C
- Chevron Phillips Chemical Company LLC
- ConocoPhillips
- Continental Resources, Inc.
- Cummins Inc.
- DCP Midstream, LLC
- Devon Energy Corporation
- HollyFrontier Corporation
- Murphy Oil Corporation
- National Oilwell Varco, Inc.
- Noble Energy, Inc.
- Phillips 66 Company
- QEP Resources
- Schlumberger Holdings Corporation
- Spectra Energy Corporation

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<sup>229</sup>[https://www.eia.gov/energyexplained/index.cfm?page=renewable\\_home#tab3](https://www.eia.gov/energyexplained/index.cfm?page=renewable_home#tab3)



The US Department of Energy has many funding programs for US companies. Nova Scotia firms would need to partner with a US firm.

Please review the **EERE Funding Opportunity Exchange**. <https://eere-exchange.energy.gov/default.aspx#FoaIddec50c74b-254b-41f5-a6ab-6b875884f9c2>

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## **OTHER SOURCES OF INFORMATION**

EIA US Energy Information Administration  
[www.eia.gov](http://www.eia.gov)

Houston Business Journal  
<http://www.bizjournals.com/houston/news/Irena-Renewable-Energy-Prospects-2015>  
<http://www.irena.org/menu/index.aspx?mnu=Subcat&PriMenuID=36&CatID=141&SubcatID=59>

Rig Zone – News [www. Rigzone.com](http://www.Rigzone.com)

Oil & Gas Journal [www.ogi.com](http://www.ogi.com)

Practical Law. Oil and gas regulation in the United States: Overview 2016,  
<http://ca.practicallaw.com/9-525-1545?source=relatedcontent>

Bloomberg Finance L.P., 2017 Sustainable Energy in America.  
<http://www.bcse.org/sustainableenergyfactbook/>

### **NOTES:**

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