

# Nova Scotia Prospect Profile Onshore 2010



Information as of January 2010

**No longer in the shadow of the offshore, Nova Scotia's onshore energy sector is gathering momentum as a hotbed for gas exploration. Over the past ten years, onshore petroleum exploration in Nova Scotia has continued to increase. The establishment of petroleum based infrastructure as a result of offshore production, including the construction of an inter-provincial pipeline which carries gas to local markets and to the north-eastern United States, and the success in the Corridor Resources' McCully gas field in New Brunswick have caught the attention of a number of companies that see the potential for exploration opportunities in Atlantic Canada.**

Onshore oil & gas exploration in Nova Scotia dates back to the 1800s, with oil wells drilled in Cape Breton. Now, the exploration focus has switched, with gas, shale gas and coalbed methane taking the lead. The province has two production agreements for coalbed methane and one production lease for shale gas. Several companies are actively working on their exploration agreements by drilling wells and completing seismic programs.

The Nova Scotia Prospect Profile Onshore 2010 provides you with a glimpse of the opportunities and potential in Nova Scotia's onshore.

Currently Elmworth Energy, the Canadian subsidiary of Triangle Petroleum Corporation, has signed off on their production lease, effective date of August 15, 2009. This lease represents the province's first onshore shale gas development and will cover a 10-year period.

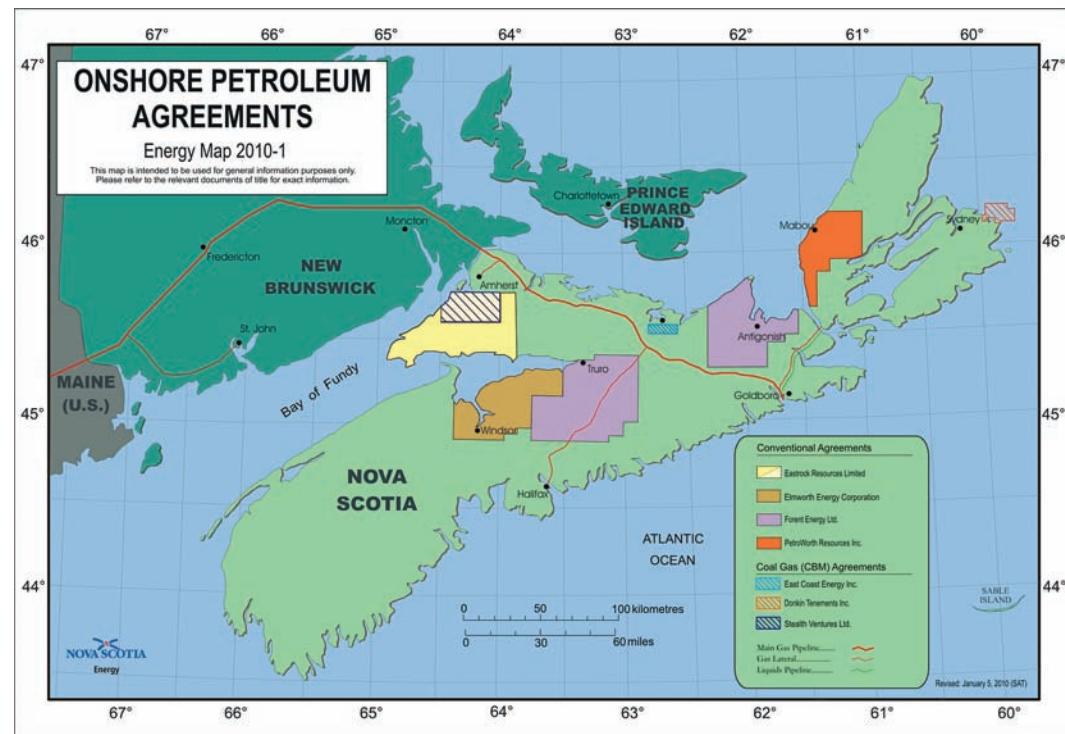
Forent Energy holds two onshore exploration agreements and are currently evaluating their plans for the upcoming year.

Stealth Ventures Ltd. holds the rights to explore coalbed methane in the Springhill area with their production agreement.

East Coast Energy Inc. holds the rights of a coal gas production agreement in the Stellarton area; and Donkin Tenements Inc. also has a coal gas agreement in Sydney Basin area of Cape Breton.

PetroWorth Resources Inc. continues to hold their conventional exploration agreement in Western Cape Breton Basin and completed their seismic program in the area.

Eastrock Resources Limited holds two conventional exploration agreements in the province in Cumberland County area.



- **Lands Nominated by Industry**
- **Competitive call for bids**
- **Open for 60 days (minimum)**
- **Up to 9-year (conventional) and 10-year (coalbed methane) terms**

**THE NOVA SCOTIA DEPARTMENT** of Energy administers onshore petroleum rights. The Petroleum Resources Act and Regulations provide for the allocation and management of petroleum rights which are issued either as exploration or production agreements, each with different periods of tenure.

Petroleum located in or under Nova Scotia lands is deemed to be vested to the Crown. There are no free-hold petroleum rights in Nova Scotia. In addition, coal gas (coalbed methane) is currently issued as a separate right with a different tenure period and applicable royalty.

#### Call for Bids

Lands may be nominated by industry at any time. Usually, this results in a competitive Call for Exploration Proposals. The Department of Energy reviews the requested parcel(s) and may modify the original parcel size and configuration in consultation with the company that has made the nomination. Public notice is given for a Call for Exploration Proposals in the Royal Gazette, posted in industry media, and through direct mailings.

The Call remains open for a minimum period of 60 days. Applicants submit a bid based on work commitment, information sufficient to judge their technical and financial capability, evidence of past experience in exploration, a commitment to meet or exceed minimum work expenditures and indicate their ability to post a bond to guarantee the performance of all work obligations.

#### Award of Rights

Petroleum rights may be granted to the applicant submitting the best proposal of work providing all other criteria have been met. The exclusive right to explore is conveyed by an Exploration Agreement which is a contractual agreement between the applicant and the Minister of Energy.

The award is made following the filing of various required documents, certificates, etc.

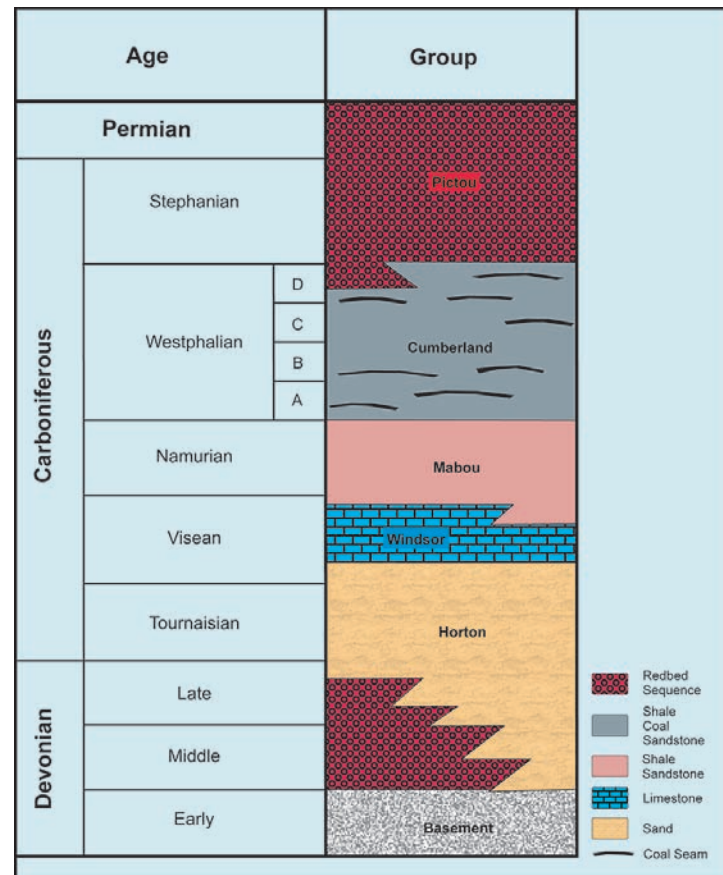
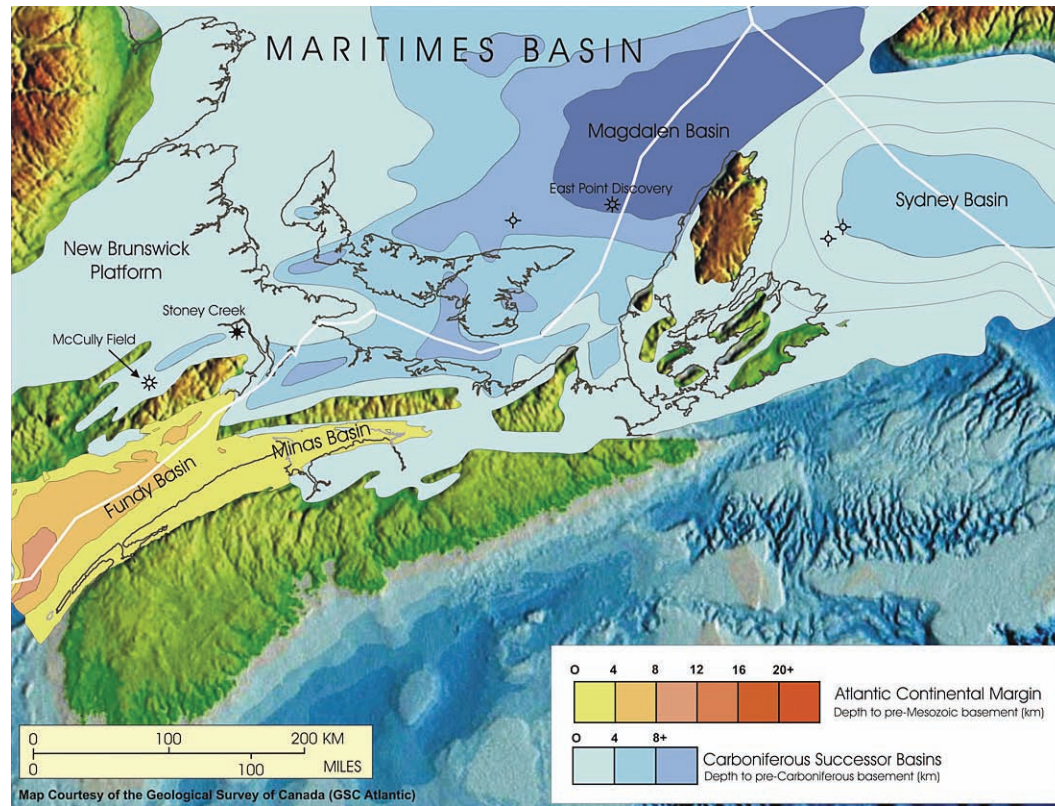
#### Work Based Continuance

For a conventional petroleum right, at least one well must be drilled in the initial three-year period. Two renewals of three years each are available for lands which continue to be explored. Coal gas rights are issued for an initial period of five years with a single, work-based, renewal for an additional five years.

A Production Agreement (Lease) for either hydrocarbon type may be issued by the Minister in response to the filing of an acceptable development program. The lease is for a term of 10 years with further renewals upon such terms and conditions as may be prescribed.

#### Royalties

Royalties are set to encourage activity and be competitive with neighbouring jurisdictions. For conventional oil and gas, there is a two-year royalty holiday after which royalty is paid at a rate of 10% of the petroleum that is produced in each month. Coal gas royalty is set at 5% of the gas produced in each month and is based on the fair market value of the gas. There is no royalty holiday for coal gas.



**THE MARITIMES BASIN** is a very large depocenter comprised of a series of very thick continental and marine sediments of the Upper Paleozoic (Carboniferous) extending over 155,000 km<sup>2</sup> covering portions of the Atlantic provinces

Carbonate banks and reefal build-ups have been the focus of successful base metal mining. In most instances the reefal facies are known to exhibit hydrocarbon shows and seeps.

Carboniferous sediments, first deposited in narrow elongate basins are bordered in the northwest by the uplands in New Brunswick and to the south by an uplifted region of pre-Carboniferous rocks in Nova Scotia

The Cumberland Group (up to 4,000 metres in thickness) contains appreciable amounts of mineable coal seams and non-marine red and grey clastics including conglomerates. During the deposition of the upper part of the Cumberland Group, non-marine fluvial and fluvio-lacustrine red and grey clastics including conglomerates of the Pictou Group were deposited in other areas. The Pictou sediments unconformably overlie older Paleozoic rocks and onlap the older metamorphic basement rocks.

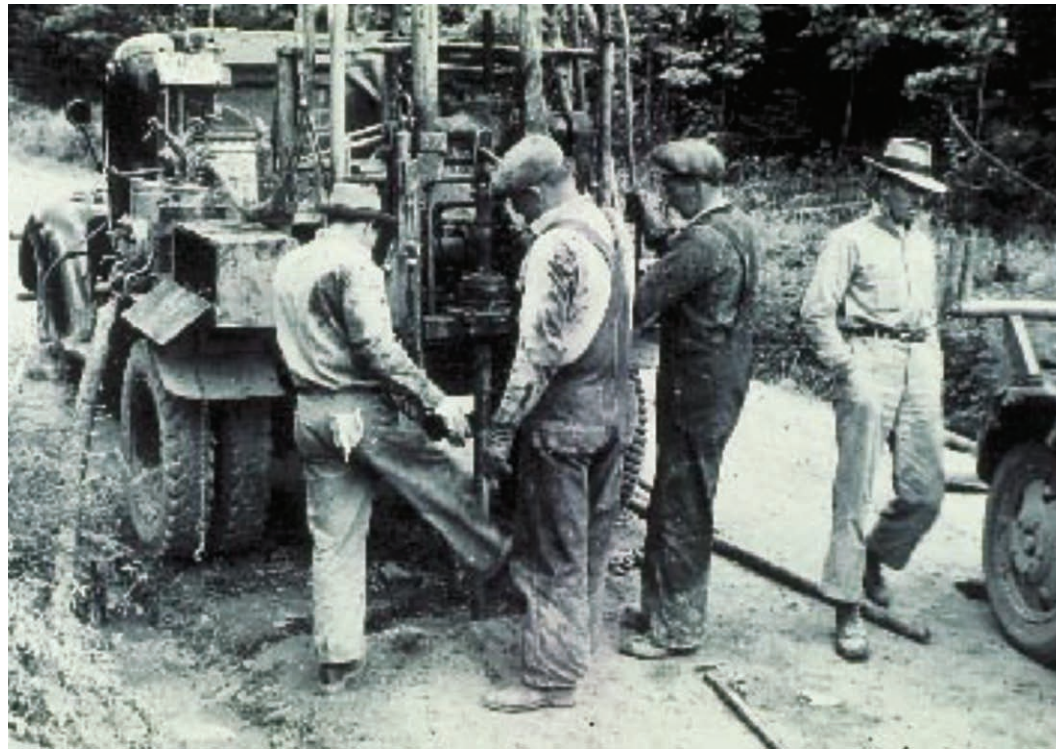
The prospective Carboniferous sediments cover 1.9 million hectares, approximately one-third of the 'onshore' Nova Scotia region, which is comprised of the actual land mass of the province together with certain submarine areas not subject to the Canada-Nova Scotia Offshore Petroleum Board's jurisdiction.

Although no commercial discoveries have yet been made onshore Nova Scotia, the success in New Brunswick bodes well for future discoveries in Nova Scotia since both provinces have similar geological settings. New Brunswick has two commercial discoveries; the Stoney Creek Field which produced oil and gas from 1909 until 1991 and the recent McCully Field discovery boasting in excess of 1 Tcf of gas in-place. McCully is producing in the range of 25 - 35 MMcf/day to the Maritimes and Northeast pipeline. Both discoveries are in the Horton Group equivalent rocks found throughout northern and central Nova Scotia. New seismic coverage in various basins/sub-basins in Nova Scotia shows more clearly the effect and control provided by faulting in these play areas. New targets for both the Horton and Windsor units have been identified and mapped and need only to be drilled to verify their potential.

Conventional petroleum exploration activity is focused on two key rock units; the Horton and Windsor Groups, and a younger unit that is of interest to coalbed methane explorers; the Cumberland Group.

Fluvial and lacustrine sediments comprise the Horton Group and consists of red to grey sandstone, conglomerate, siltstone and shale, which can be up to 3,000 metres thick. Historical seeps and shows, coupled with drilling have demonstrated the presence of both oil and gas in the thick, clean clastic units of this Group. High organic lacustrine shales within this Group are the identified source rocks

Overlying the Horton Group strata are younger rocks of the Windsor Group which represents the only marine incursion in the central Maritimes Basin. The unit varies in thickness from a few meters to greater than 1500 meters and consists of massive to poorly bedded clastics which are interbedded with thick deposits of gypsum, anhydrite, and tabular sequences of limestone and dolomite. Thick salt deposits occur at a number of localities and have caused noticeable deformation forming diapirs, domes and ridges.



### 131 years of exploration

- 133 wells drilled (only 35 went more than 1,000m)
- 26 wells in past seven years
- 2,100 km of seismic in past ten years
- First 3-D seismic survey and horizontal well in 2004
- Multi-well exploration program in 2005
- Multiple horizontal coalbed methane wells in 2006
- 4 exploration wells in 2007
- Approval for Stealth Ventures Coal Gas Development Plan Fall 2007
- 4 exploration wells in 2008
- Approval for Elmworth Energy Development Plan in 2008
- 2 seismic programs in 2009

### Activity: Past – Present – Future

Nova Scotia has drilling records dating back to 1869, when several wells were drilled near Lake Ainslie on Cape Breton Island. Oil-seeps along the shores of the lake and numerous shows and flows in wellbores led to a number of shallow wells being drilled over the last 130 years. Small quantities of oil have been recovered for analysis and testing but no commercial production has been established.

**1869** – the first well drilled onshore by Lake Ainslie Oil and Salt Company on the west side of Lake Ainslie. It flowed small amounts of oil and natural gas.

**1909** – the discovery of the Stoney Creek oil and gas field in New Brunswick spurred more activity in Nova Scotia where the rocks units are the same.

**1978 to 81** – Chevron Standard discovers oil in the Malagawatch area, Cape Breton while conducting a base metals program targeting the Windsor carbonate build-ups.

**1987** – an uncontrolled flow of gas lasted for a period of three weeks in a shallow well in central Nova Scotia near Truro.

Of the approximately 125 wells drilled specifically for oil and gas, only 27 were drilled deeper than 1,000 metres and 41 went less than 200 metres. There have been shows in one third of these wells in addition to shows in another 66 mineral boreholes.

### Recent Years

There's been a resurgence of activity in recent years with more companies vying for onshore land positions. This may be attributable, in part, to discoveries in New Brunswick, results from current technology seismic programs and the availability of a pipeline to carry natural gas to market.

These factors help make potential onshore developments more economically feasible.

**2000** – 15 exploration agreements held by four exploration companies.

**2000** – Corridor discovered the McCully Field in New Brunswick, currently producing 2 MMcf/d from the Horton Group.

**2001** – the highest level of activity with 550 km of seismic acquired and five wells drilled by Northstar Energy/Devon Corporation.

**2002** – one well drilled and five seismic programs acquired.

**2003** – three Calls for Exploration Proposals at industry's request. Four seismic programs and two exploratory wells drilled.

**2004** – two Calls for Exploration Proposals resulted in the awarding of four parcels of land. Nova Scotia's first horizontal well was undertaken while the first 3-D seismic survey was completed.

**2005** – three wells were drilled.

**2006** – three Calls for Exploration Proposals resulted in the awarding of one conventional parcel and an unconventional parcel is pending. Four horizontal coalbed methane wells were drilled.

**2007** – two seismic programs, four new exploration wells drilled, approval for Stealth Ventures Coal Gas Development Plan.

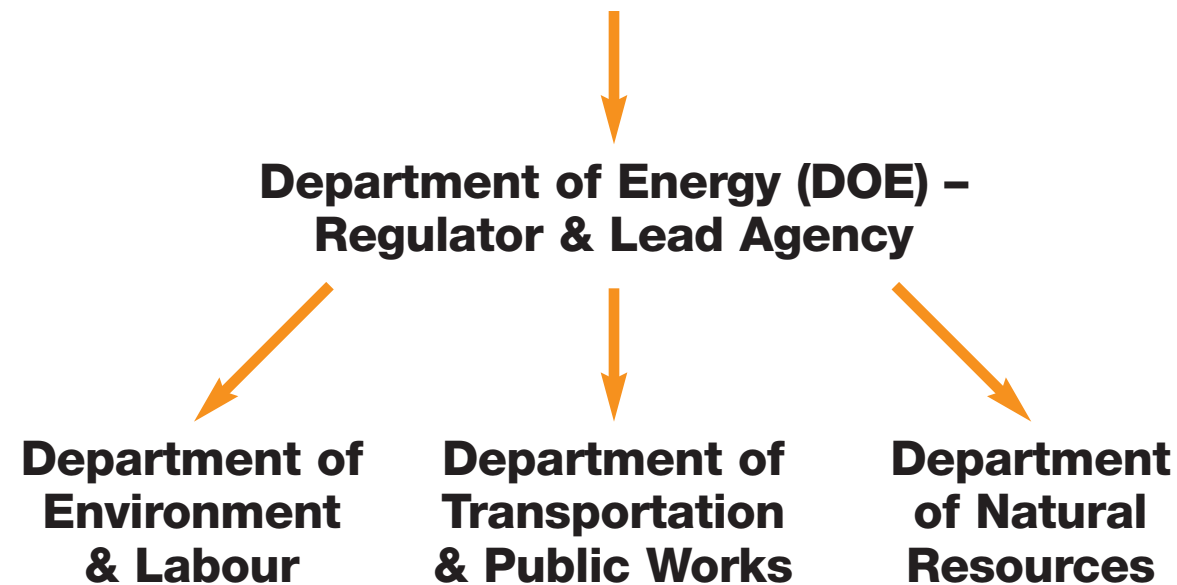
**2008** – one seismic program, four wells drilled, approval for Elmworth Energy Development Plan for Shale Gas.

**2009** – two seismic programs.

### Future

The next few years will be important to Nova Scotia's onshore as new companies employ new ideas and technologies and more detailed seismic, including 3-D, to define new targets. Application of slim-hole and horizontal drilling technology will minimize environmental impact and enable companies to validate newer play concepts. There is a new exploration focus on shale gas and this is expected to continue in the coming years.

## One Window Standing Committee



- Streamlined Approvals
- Public Consultation
- Regional Cooperation
- Improved Legislation

**THE RE-WRITING** of the Energy Act and regulations will be an opportunity to create a more responsive system that will encourage continued exploration activities.

Stakeholder meetings with industry clients will ensure the outputs will address our onshore regulatory environment.

The Department of Energy will create its own petroleum registry for both database management and to create an efficient process in awarding and tracking rights and providing information to clients.

### Technical Expertise

There is a strong commitment to improve the management of, and access to, technical data. The Department understands the importance of resident expertise in the petroleum aspects of the Carboniferous Basins onshore Nova Scotia. Staff expertise and good working relationships with the geoscientific community help ensure access to needed resources.

The Department has contracted experts to evaluate the petroleum potential of selected areas; source rock studies and petroleum systems analyses of various basins have been conducted. The Department of Energy led a project to assess the petroleum

potential of basin/sub basins in Cape Breton, which was completed in August, 2004. This study assessed the geological and geochemical components of three areas of Cape Breton with an emphasis on evaluating the petroleum potential of each. The results will help guide explorers to the most prospective areas on Cape Breton Island.

An onshore seismic database has been developed by the GIS experts at the Department of Energy and the Department of Natural Resources. Shapefiles consisting of seismic line and shot locations is now available through the Department of Natural Resources website:

<http://www.gov.ns.ca/natr/meb/pubs/pubs3gpsei.htm>

### Regulatory Efficiency

The Department of Energy is committed to improving regulatory efficiency through a number of important initiatives:

**Streamlined Approvals.** The Department of Energy chairs a One-Window Standing Committee, which brings together all government departments involved with the approval of each activity. This forum facilitates compliance with regulatory requirements before an activity begins.

**Guidance Notes.** The Department of Energy has created a series of guidance notes to help industry understand the regulatory requirements ahead of time. The new Energy Act and Regulations will emphasize the use of outcome-based guidance notes and codes of practice, rather than prescriptive, procedurally-based regulations. Guidance notes and codes of practice allow more flexibility for industry, but clearly identify the outcomes the regulations require. Guidance Notes and Forms are available through the Department of Energy website:  
<http://www.gov.ns.ca/energy/AbsPage.aspx?siteid=1&lang=1&id=1388>

**Public Consultation.** Public consultation is a condition of the activity authorization and may involve public meetings or open houses. It is important for the public to be

able to discuss their concerns and ask questions. Department of Energy staff are present to answer any pertinent questions and provide assurance that industry is compliant with the regulations.

### Community Involvement.

The Department of Energy created a Multi Stakeholder Advisory Committee (MSAC) to deal with coalbed methane development in the Springhill area. The committee consists of a broad range of community members including representatives of the following groups: Town of Springhill; Municipality of the County of Cumberland; Cumberland Regional Economic Development Association; at-large community members; local business, education and industry; provincial government departments; and others. The MSAC meets three times a year to receive information, address issues/concerns, and make recommendations to the Department of Energy relating to petroleum activity in that area. A set of Fact Sheets were created to educate both this group and the public on coalbed methane development. These are available on the Department of Energy website.

**Regional Cooperation.** The Department is currently working with neighbouring jurisdictions in Atlantic Canada to provide for more efficient industry operations across the region. Consideration is being given to common inspection and approval for various oilfield equipment, a single registry for seismic and drilling contractors, and standardization of approvals and time lines. Consistency will benefit companies and contractors operating in more than one of the Atlantic provinces.

### Conclusion

Nova Scotia has the right mix of flexibility and commitment needed to grow an oil and gas industry in our onshore. Given recent efforts by industry, new generation of seismic, creative drilling technology, new exploration strategies and government's commitment to facilitating industry's efforts, it is simply a matter of time until Nova Scotia becomes the next onshore producing province.



**NOVA SCOTIA HAS HISTORICALLY** derived employment and revenue from a well established coal industry. Some 265 years of mining activity and geological research have generated a wealth of knowledge for the province's three main coal basins; the Cumberland, Stellarton and Sydney basins. These three basins contain more than a hundred seams ranging in thickness from less than 1 meter to almost 15 meters. These bituminous coals have long been known to be "gassy"; the dilemma has been how to produce this gas from the coals?

In the late 1970's and early 80's an attempt was made by the private sector to characterize the coalbed methane potential of a number of Nova Scotian coals. Algas Resources Ltd. of Calgary, Alberta Canada drilled 26 holes in an attempt to gather fresh samples for desorption measurements. Two of these wells were brought on production and flowed, but daily rates were low (25 mcf/day) and local customers could not be lured in to any long term commitments. As a result these wells were abandoned.

Since that time 13 more exploration wells have been drilled targeting coalbed methane. The majority of these wells have been conventional vertical wells, however in 2004 Stealth Ventures Ltd farmed into Amvest Oil and Gas Inc. completed Nova Scotia's first horizontal well. This new technology created a new approach for coalbed methane exploration and development in Nova Scotia. Stealth Ventures Ltd. of Calgary has since acquired all of Amvests exploration interests in Nova Scotia and has recently undergone an aggressive horizontal drilling program in the Cumberland and Stellarton basins.

Stealth Ventures drilled four horizontal wells in Nova Scotia in 2006 and a testing program in 2007. These wells were successful engineering feats with extended horizontal reaches exceeding 100 meters. Stealth has achieved one of its main objectives which was to overcome any mechanical risks in horizontal drilling within these basins.

Early in 2006 Stealth Ventures hired Sproule Associates Limited of Calgary to assess the coalbed methane potential on both of their exploration blocks in the Cumberland and Stellarton basins and Sproule has completed a report recognizing 1.6 TCF of discovered coalbed methane resource. Stealth submitted an Application for a Production Agreement in 2007 in the Springhill area. Approval was granted in late 2007 and Stealth Ventures continues to work under this agreement.

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