

# Creating a New Understanding of Nova Scotia's Offshore Petroleum Potential

## The Play Fairway Analysis: History & Rationale

Offshore Nova Scotia has had a dynamic history as a petroleum exploration region with its first exploration well marked in 1967 and the first discovery found in 1969. Over 200 exploration, delineation and production wells were drilled during the last four decades with discovered reserves in the range of 2.1 billion barrels of oil equivalent (boe). The remaining resource potential of Nova Scotia's offshore, as estimated by the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB), ranges from 12- to 39-trillion cubic feet (tcf) of natural gas and between 1.3- and 4.5-billion barrels of oil. Despite this potential, exploration interest has sharply declined over the past decade. Exploration licenses decreased from 59 in 2002 (valued at over \$1.5 billion in expenditure bids) to just 6 in 2011 (valued at only \$370 million). This reduction in offshore activity has had a major financial impact on the province's revenue with a significant drop in royalty payments and reduced economic spin-offs.

As a first step in addressing the decline in activity, in 2007 the Nova Scotia Department of Energy commissioned a geoscience gap analysis and participated in an international competitiveness study. This work pointed to a fundamental challenge: complex offshore petroleum geology carrying an inherently high risk for exploration companies. While proven discoveries and commercial production have demonstrated the existence of a working petroleum system in the offshore, geological uncertainty, due to a lack of recent exploration successes, pointed to the need to better understand the offshore geology before significant new investment would return.

In September 2008, the Nova Scotia Department of Energy invested \$15 million in the OETR Association (OETR) and tasked it with undertaking research that would improve geoscience knowledge of the offshore. OETR then initiated an industry-standard petroleum Play Fairway Analysis (PFA) and Geoscience Data Package Program in the spring of 2009. The program is working to fill the identified geoscience knowledge gaps as well as gain a more comprehensive understanding of the current body of knowledge surrounding Nova Scotia's offshore geoscience.

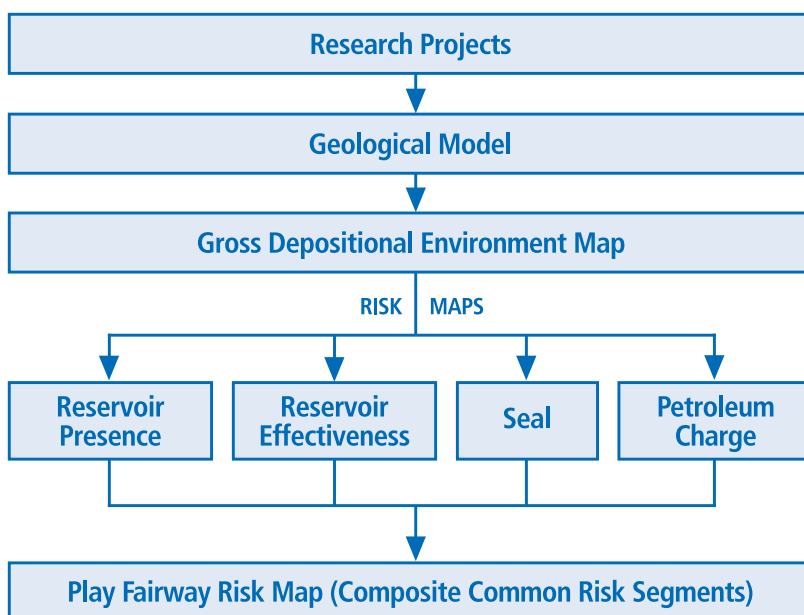
## OETR Association

OETR is a not-for-profit corporation that was established in March 2006 with seed funding from the Nova Scotia Provincial Government. OETR is dedicated to fostering offshore energy research that will help develop Nova Scotia's offshore petroleum exploration and development, as well as research that reduces technical and engineering barriers to the development of discovered reserves. OETR's members include Dalhousie University, Saint Mary's University and the Nova Scotia Department of Energy.

## The Research Process & Players

Much of the past offshore oil and gas exploration efforts used approaches that are now superseded by new geological ideas and technologies. Many exploration companies employed traditional risk analysis techniques for specific prospects; techniques still considered to be necessary but narrow in scope. The PFA broadens the scope of study to include a basin-wide assessment of risk, which will high grade each basin's most prospective sections, enabling a greater ability to classify different basins or rank parts of a specific basin. In addition, through the use of different geological, technical or paleo-environmental concepts, new plays can be identified in less explored basin areas.

OETR's PFA research methods employed a number of distinct projects, the results of which were combined into the final Play Fairway Analysis and Data Package Program. OETR's approach is unique in that it has brought international collaborators into research and development teams with members from local universities, government research labs, as well as exploration contractors and specialists within regulatory organizations. Recognized industry experts, with global exploration decision-making experience, were teamed with world-class research geoscientists to form integrated units to provide viable and peer reviewed solutions to complex geological questions. What makes this work unique is that the results will be made available to public, private and academic sectors. This is in marked contrast to the modern day private sector approach where the results would typically be kept proprietary.



Play Fairway Analysis Activity Flowchart

Biostratigraphy research including new analysis (micropalaeontological, nannofossil and palynological) is being integrated with seismic interpretation, sedimentological data and tectonic models to build a comprehensive sequence framework.

## Program Components and Integration

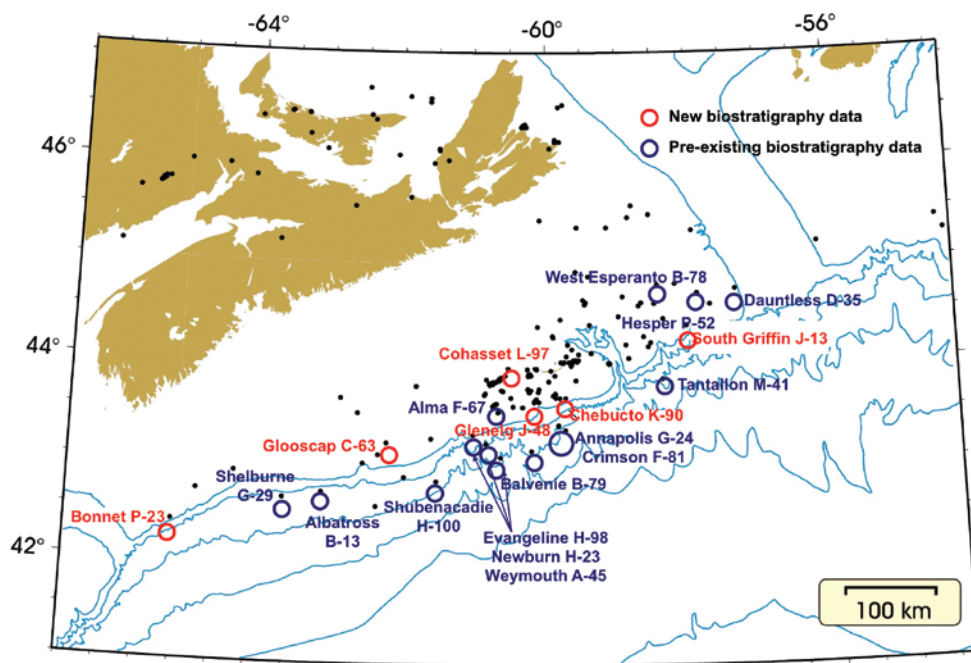
RPS Energy, under the governance and funding of OETR, managed the PFA program through direct application of its technical expertise coupled with the coordination of studies being performed by the PFA's various subcontractors. The PFA includes a series of individual projects which, when integrated, reveal total petroleum volume in place and relative risks for offshore Nova Scotia. The projects address such study areas as:

- Plate tectonics analysis;
- Biostratigraphy and sequence stratigraphy;
- Reprocessing of 7,500 km of key regional 2D seismic lines;
- Seismic interpretation including salt kinematics theories and modeling techniques;
- Understanding controls on reservoir quality and distribution;
- Geochemistry and petroleum systems modeling; and
- Integrated play fairway evaluation.

The results of the individual projects were integrated to develop a standard play fairway analysis. This integration was conducted by the PFA contractor, Beicip-Franlab of France. The knowledge within the CNSOPB and the Geological Survey of Canada extended across the whole exploration analysis chain and was instrumental in this process.

A fundamental part of the PFA was the construction of a robust sequence stratigraphic framework through an extensive biostratigraphy project. The work included age calibration of key wells across the margin, finding and understanding the nature of seismically mappable surfaces and development of a regional tectono-stratigraphic and sequence stratigraphic framework by integrating well and seismic data.

The detailed analysis of the seismic maps, in conjunction with palaeo-environment interpretations from the wells, allows the creation of Gross Depositional Environment (GDE) maps for individual sequences. The PFA integrates the GDE mapping with Geochemistry and Petroleum Systems modeling and provides new knowledge about the play systems as well as where exploration is best directed.



## Peer Review

An industry workshop was held in Paris, France over a two day period in late January, 2011, where leading international exploration companies conducted an external peer review of the PFA. The peer review process concluded that the scientific and technical work has been delivered at a standard that would be performed by a super-major oil and gas exploration company. Therefore, OETR is confident that the PFA research is of world-class caliber and that the PFA is poised to become an invaluable exploration tool to inform, attract and retain explorers.

## Deliverables

PFA deliverables will include a digital atlas that presents the results of the projects, as well as a sample data package. Gross Depositional Environment (GDE) and Common Risk Segment (CRS) maps will be created for key geological sequences which in turn will allow the development of a final Yet-to-Find (YTF) analysis for petroleum play types. The atlas will contain montages of maps derived from the various analyses. In addition, it will have scientific appendices providing the technical background behind each project and a GIS compilation of the maps. The final steps of the project will include refinement of the present work and completion of work which includes a Phase 2 Jurassic Carbonate Bank Analysis. The PFA results are also being developed for submission to a peer reviewed special edition journal.

The final PFA results will be made available after the project's science and technical milestone completion date, expected March 31, 2011. Future reports and a corresponding data package will present comprehensive findings that demonstrate reduced exploration risk for industry stakeholders. •