



Offshore Energy  
**Technical**  
Research  
Association

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# Who We Are

The 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 geoscience research that will enhance Nova Scotia’s offshore petroleum exploration and development.

OETR’s members include Dalhousie University, Saint Mary’s University and the Nova Scotia Department of Energy.



# Mandate

OETR’s mandate is to fund and encourage research that builds geoscience knowledge about Nova Scotia’s offshore oil and gas potential, as well as research that reduces the technical and engineering barriers to the development of discovered reserves.



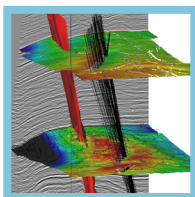
# OETR Research Focus Areas

## Play Fairway Analysis and Geoscience Data Package Program

In Spring 2009, OETR initiated an industry standard play fairway analysis and geoscience data package program for offshore Nova Scotia. This program will work to fill geoscience knowledge gaps and encourage industry exploration of Nova Scotia's offshore resources.

## Geoscience Research

As part of its mandate to build geoscience knowledge, OETR has funded a variety of geoscience research projects. These include three projects undertaken by local academic researchers, and a project that archived and reprocessed 2-D and 3-D data acquired offshore Nova Scotia in the 1980's and 1990's.



## Georges Bank Seismic Data Reprocessing

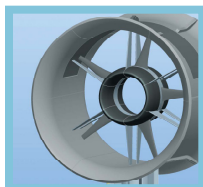
OETR has funded a study for the transcribing, reprocessing and interpretation of seismic field data acquired from Georges Bank in the 1970's and 1980's. The reprocessing will improve the quality of the data, and assist governments' understanding of the geology and potential petroleum reserves. This research is intended to serve as an aid in decision-making surrounding the current Georges Bank moratorium on petroleum activities.

## Marginal Fields Development

In order to encourage further development of Nova Scotia's offshore, OETR has funded research that reduces development risk and increases resource profitability. This work has produced a cost estimate tool, the Sable Offshore Minimum Infrastructure Tool (SOMIT), to help industry determine the economic viability of developing Nova Scotia's "Marginal Fields".

## Tidal Marine Energy

OETR and OEER have approved eight joint research projects in the area of tidal marine energy development in the Bay of Fundy. Projects address environmental and technical knowledge gaps, and collect information related to the potential environmental effects of tidal energy extraction and tidal technologies on the surrounding environment.



# Funded Research

## Play Fairway Analysis and Geoscience Data Package Program

The OETR Play Fairway Analysis (PFA) and Geoscience Data Package Program is intended to serve a pivotal role in stimulating industry interest in the exploration of Nova Scotia's offshore petroleum resources by providing explorers with critical information about prospectivity and resource potential to aid in decision making.

Exploration history has shown complex geological problems that must be solved in order to demonstrate to the industry that there is a viable, attractive hydrocarbon region offshore Nova Scotia. Standard approaches to unlocking the hydrocarbon potential have not been successful in providing information on the viability of the Scotian Shelf. Exploration companies traditionally have used risk analysis for specific prospects, however this approach narrows geoscience and resource evaluation examinations.

By enlarging the scope of a study to include a basin-wide assessment of risk, companies can devote exploration resources to a basin's most prospective sections, which enables a greater ability to classify different basins or rank parts of a specific basin. In addition, through the use of different geological, technical or environmental concepts, new plays in less explored basin areas can be examined. OETR's PFA method employs the use of various projects, each undertaken by different researchers, that are combined into the final play fairway analysis.

Areas of research include:

- Plate Tectonics
- Carbonate
- Biostratigraphy and sequence stratigraphy
- Geochemistry
- Petroleum Systems Modeling
- Seismic Reprocessing
- Salt Structural Interpretation
- Reservoir Quality
- Integrated Play Fairway Evaluation

Studies in these areas are being conducted by local, national and international experts from government, academia and industry. The projects are designed to incorporate leading academic research being undertaken in Halifax into the overall Play Fairway Analysis Program.

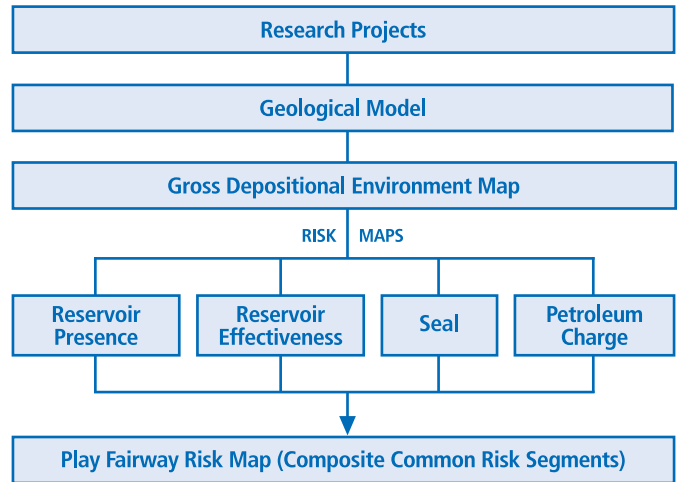
## Play Fairway Analysis and Geoscience Data Package Program (cont'd)

All projects will build on the extensive expertise that exists in the region. All these research activities feed directly into the work performed by the PFA contractor, Beicip-Franlab, who will integrate the input from these projects and develop appropriate tools in order to provide the oil industry with new plays and exploration models (see PFA activity flow chart across the page).

Integration is happening throughout the duration of the research and outputs are shared along the way to inform the work being performed by Beicip-Franlab. The work covers a diverse range of geological expertise in biostratigraphy, seismic stratigraphy, petrophysics, clastic and carbonate sedimentology, geodynamics, geochemistry, thermal history, salt and plate tectonics, and petroleum systems modeling. Beicip-Franlab, with assistance from other members of the PFA team, has built a project database, created a stratigraphic model, and undertaken seismic interpretation. The work has relied on significant integration which has included:

- A team of biostratigraphers, seismic stratigraphers and petrophysicists/sedimentologists working together on well-seismic ties;
- The seismic interpretation team working collaboratively with the seismic processing teams to reprocess TGS and GXT data;
- Integrating substantial existing work of the CNSOPB technical team on salt mapping into PFA work flow;
- The tectonics team collaboratively working out issues of rifting history, timing and accommodation space for source rock deposition;
- Seismic and well data gathering missions being conducted by Beicip-Franlab in Halifax and Calgary;
- RPS exploration experts periodically reviewing the work conducted by Beicip-Franlab in Paris to advise on program direction and to guide the quest for new exploration insights.

The creation of a data package is an important element of the PFA. This package will enable interested companies to test proposed hydrocarbon models on real data to aid their evaluation of prospects. The PFA data package is made up of two parts. First, data owners have agreed to commercial terms under which digital data can be used for the

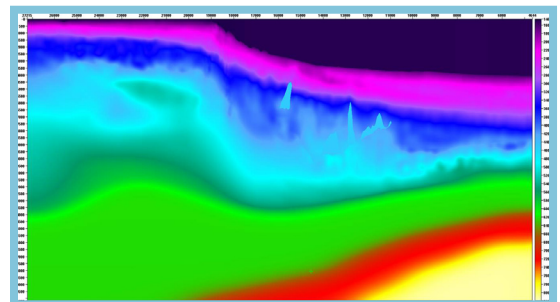


Play Fairway Analysis Activity Flowchart

study and images can be presented in a way that does not compromise the market value of the base data. Second, where data may be enhanced, OETR and data owners have negotiated reprocessing activities to improve imaging that increases the predictive quality of the data.

OETR is optimistic that the results of this program will make Nova Scotia's offshore an attractive area for development by industry companies. The goal of this work is to renew industry interest in developing Nova Scotia's offshore resources, benefitting Nova Scotians through offshore royalty payments.

OETR is currently reviewing early findings from the PFA work and identifying potential research priorities beyond the PFA. For more information on the PFA, please read OETR's newsletter "Profile", which is a series of issues featuring PFA research progress and highlights.



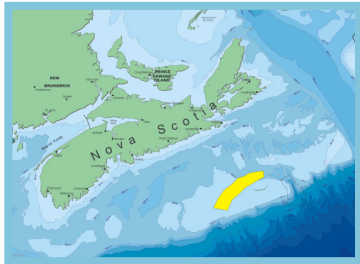
Line NS-2000: Calculated Velocity During 2010 Reprocessing  
Photo courtesy of ION-GXT

# Funded Research

## Geoscience

### *Archiving 2-D/3-D Seismic Dataset*

From 2007-2008, OETR awarded funding to Kelman Technologies Inc. to archive the Scotia Shelf 2-D and the Penobscot 3-D seismic datasets as well as reprocess the Penobscot 3-D dataset, acquired just north of Sable Island along the northern portion of the Jurassic Age carbonate bank. The original data was acquired in the mid-1980s and early 1990s to evaluate regional oil plays similar to the Cohasset, Balmoral and Panuke Oil Fields comprising the Cohasset Project. In July 2008, Kelman Technologies Inc. completed the reprocessing of an additional 695 km of 2-D data.

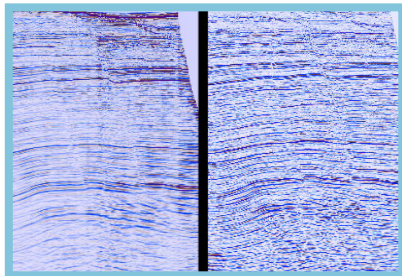


General location of Scotian Shelf 2-D and Penobscot 3-D Seismic programs

Reprocessing has improved the data dramatically by increasing the Signal-to-Noise (S/N) ratio, thereby improving the interpretability of the data. It especially provides better definition around faults and more continuous seismic reflectors.

The improvements in both data sets are important to providing a better understanding of the Penobscot area as well as a better regional understanding of the Jurassic Age carbonate bank from the Deep Panuke discovery to its northeastern extent. This data is important to industry because it allows for the evaluation of new exploration opportunities by educational and research institutions that can employ it both as a research and teaching tool.

The data reprocessing, using up-to-date algorithms, has been completed, and both the field and reprocessed data are available in digital SEG-Y format at the CNSOPB's Digital Data Management Centre (DMC). Access to this data is free of charge, which is consistent with OETR's mandate to make more geological information available to current and future industry.



Old section (left), new section (right)

OETR is committed to enhancing offshore Nova Scotia's petroleum exploration and development. A key component of this is building geoscience knowledge about its offshore oil and gas potential. In August 2007, OETR awarded funding for three projects that were carried out over a three-year period.

The three funded projects are described as follows:

### *Analysis of Petroleum Systems on the Scotian Shelf using Thermal & Seismic Techniques*

*Dr. Keith Loudon, Dalhousie University*

This research will lead to a better understanding of the nature of basement and salt structures and their effect on petroleum maturation. It will also provide the groundwork for seismic characterization of sedimentary physical properties for improved definition of petroleum reservoirs.

### *River Sources & the Transfer of Sands to Deep Water Lower Cretaceous of the Scotian Basin*

*Dr. Georgia Pe-Piper, Saint Mary's University*

This study works to define the distribution systems for sand and help industry explorers refine their exploration targets and better understand the quality of underground petroleum reservoirs. This project addresses key questions in resolving the issue of how much sand has been transferred from the Cretaceous deltas to deepwater.

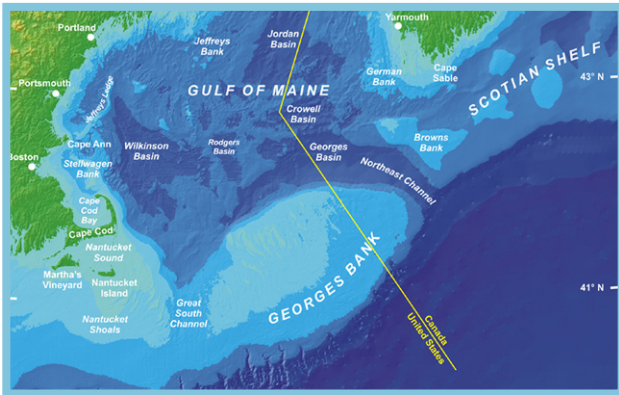
### *Reservoir Distribution & Characterization: Shelf to Slope Linked Depositional Systems*

*Dr. Grant Wach, Dalhousie University; and Dr. David Mosher, Geological Survey of Canada (Atlantic)*

This project investigates reservoir distribution within the petroleum system. It will provide industry with the groundwork for a better understanding of petroleum reservoirs. The objectives of this research are to understand the complexities of shelf to slope sedimentation patterns within a sequence stratigraphic framework to be able to predict intervals with the potential to be petroleum reservoirs.

# Funded Research

## Georges Bank Seismic Data Reprocessing



Georges Bank represents an important ocean area to Canada from a broad political, social, economic, and environmental perspective. The Nova Scotia government has provided funding to OETR to support scientific research on matters specific to Georges Bank.

Estimates on potential for discoveries have been variable. OETR has funded a study to transcribe, reprocess and interpret seismic data on Georges Bank that was originally acquired during the 1980's.

The project involved transcribing (demultiplexing) over 5,000 (9-track) field tapes into trace sequential format, reprocessing and analysing this data to generate a modern assessment of the petroleum potential in the area. It is expected that the reprocessing will provide better imaging of stratigraphic and structural features by:

1. increasing signal to noise ratio;
2. improving coherency and continuity of reflectors; and
3. migrating dipping reflectors to their proper 2-D location.

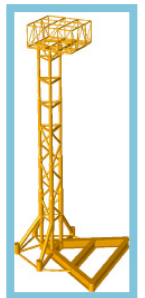
The study will improve the quality of the data and interpretation will lead to a better understanding of the geology and potential petroleum reserves.

# Funded Research

## Development of Marginal Fields

Economic viability of an offshore development is largely related to the cost of the offshore facility that will extract and distribute the gas. Many of Nova Scotia's remaining offshore fields fall into "Marginal Field" status, meaning their economic viability is questionable and they do not have recoverable reserves as significant as the Sable or Deep Panuke fields. Other areas around the world have faced similar issues and some have become economically viable by reducing the cost of the offshore facility used to extract and distribute the gas or oil. OETR has received funding from the Department of Energy to conduct research that will encourage development of these marginal fields by reducing development risk and increase resource profitability.

To enhance prospectivity, OETR-funded research investigated alternative or minimal development strategies and whether they are applicable to Nova Scotia. OETR awarded contracts to Martec Limited, a local engineering firm, to complete a two-phase study with the intent to create tools that will assist potential developers in understanding our local economic resources. Both phases are now complete.



Minimal Satellite Structure

### Phase 1

The first phase resulted in a report on the known types of minimal platforms and their appropriateness for use in Nova Scotia's harsh environment. Phase 1 found support for the use of several types of minimal platforms suitable for offshore Nova Scotia.

### Phase 2

The second phase used the various minimal platforms identified in Phase 1, along with production studies, operational and fabrication requirements, as well as existing and potential new infrastructure, to determine the cost impact of developing marginal fields offshore Nova Scotia. This was achieved through the development of a cost estimation tool called the Sable Offshore Minimum Infrastructure Tool (SOMIT). The tool will provide developers basic, yet specific, infrastructure data and information that could be used to outline the physical facilities required for a specific field development.

# Funded Research

## Tidal Marine Energy



With a broad range of experienced researchers from industry, government and academia to draw on, Nova Scotia has the opportunity to develop a strategic tidal energy research agenda. In May 2009, OEER and OETR issued an Invitation for Expressions of Interest (EOI) for research on Hydrodynamic Modeling of the Bay of Fundy and other key research areas. In November 2009, eight projects ranging in duration from two to three years, were approved and are currently underway. Combined, these projects create the most comprehensive research program ever undertaken on hydrodynamic modeling in the Bay of Fundy region.

Areas of research include:

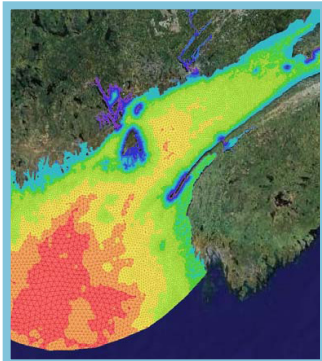
- Tidal Resource Assessment
- Sediment Dynamics
- Animal Behaviour
- Near- and Far-Field Effects
- Potential Effects of Ice and Debris
- Potential Effects of Tidal Lagoons

The eight funded projects are described as follows:

### **Assessment of Hydrodynamic Impacts Throughout the Bay of Fundy and Gulf of Maine Due to Tidal Energy Extraction by Tidal Lagoons**

*Dr. Andrew Cornett, Canadian Hydraulics Centre (CHC)*

Dr. Cornett and his colleagues from the CHC are extending existing hydrodynamic models of tidal flows in the Bay of Fundy to simulate the presence and operation of a tidal lagoon project located in the Minas Basin. They will attempt to predict and identify changes in water levels, potential impacts on the flow of sediments, tide range and circulation throughout the Bay of Fundy.



### **Impacts of Tidal Energy Extraction on Sediment Dynamics in Minas Basin, Bay of Fundy, NS**

*Dr. Peter Smith, Fisheries and Oceans Canada; Dr. Ryan Mulligan, East Carolina University*

Dr. Smith and Dr. Mulligan, together with researchers from Fisheries and Oceans Canada and Dalhousie University, are developing a numerical hydrodynamic and sediment transport model for Minas Basin, focusing on the sediment dynamics of the tidal inlets and flats.

### **Assessing the Far Field Effects of Tidal Power Extraction on the Bay of Fundy, Gulf of Maine and Scotian Shelf**

*Dr. Jinyu Sheng, Dr. Keith Thompson, and Dr. Paul Hill, Dalhousie University; Dr. David Greenberg, Fisheries and Oceans Canada*

Dr. Sheng, Dr. Thompson, Dr. Hill and Dr. Greenberg are working to quantify the far field effects of tidal power extraction, with a particular focus on tides, frequency of coastal flooding, tidal current patterns, the vertical and horizontal distribution of temperature and salinity, and large-scale sediment distributions.

### **Assessment of the Potential of Tidal Power from Minas Passage and Minas Basin**

*Dr. Richard Karsten, Acadia University; Dr. David Greenberg, Fisheries and Oceans Canada; and Michael Tarbotton, Triton Consulting*

Dr. Karsten has teamed up with Dr. Greenberg and Mr. Tarbotton to use ocean coastal modeling to assess the power potential of the tides and tidal currents in the Minas Basin and Minas Channel regions of the Bay of Fundy. estimates will be based on current turbine technology and will take into account the impact on the tidal range and currents.

### **Effects of Energy Extraction on Sediment Dynamics in Intertidal Ecosystems of the Minas Basin**

*Dr. Danika van Proosdij, Saint Mary's University*

Dr. van Proosdij and her team are assessing how the dynamics of sedimentation change when energy is extracted from a macrotidal system. The differences in



tidal prism and energy between neap and spring tidal cycles will be used as a proxy for energy extraction due to in-stream tidal power devices.

## Tidal Marine Energy (cont'd)

### *Investigation of the Vertical Distribution, Movement and Abundance of Fish in the Vicinity of Proposed Tidal Power Energy Conversion Devices*

*Dr. Norman Cochrane and Dr. Gary Melvin,  
Fisheries and Oceans Canada*

Dr. Cochrane and Dr. Melvin are working with other researchers at Fisheries and Oceans Canada, Coda Octopus and ROMOR Atlantic to study Minas Passage turbine active fish avoidance using Coda Octopus Echoscope II 3-D multibeam sonar mounted on a bottom platform in close proximity to a turbine. The objective is to observe and quantify the distribution and abundance of fish in the water column and their ability to detect and avoid turbines.

### *3-D Acoustic Tracking of Fish, Sediment-Laden Ice and Large Wood Debris in the Minas Channel of the Bay of Fundy*

*Dr. Michael Stokesbury and Dr. Anna Redden,  
Acadia University*

Dr. Stokesbury and Dr. Redden, in collaboration with the Ocean Tracking Network and a broad team of researchers and consultants, are using VEMCO animal tracking technology to complete in-situ testing of the path, depth and velocity of fish and objects passing through the Minas Passage. Using hydrodynamic models, they will determine the potential for interaction of fish and objects with turbines installed in the water column, and provide advice on risk and mitigation to regulators and developers.

### *Near-Field Effects of Tidal Power Extraction on Extreme Events and Coastline Integrity in the Bay of Fundy*

*Dr. James Warner, Martec Limited*

Dr. Warner and Martec Limited, with Dalhousie University, are quantifying the near-field effects of power extraction on the resulting effects of extreme storm events and coastline integrity by implementing a spectral wave model to numerically simulate wave transformation for tidal current conditions with and without turbines.

In partnership with the Fundy Ocean Research Centre for Energy (FORCE), OEER hosted a workshop in October 2010 for the eight funded research projects to present year 1 results. There was facilitated discussion on future priority research areas including environmental effects monitoring, near- and far-field effects, and resource assessment and extraction potential. OEER and OETR will use priorities generated from this workshop to define future areas of research.

## Nova Scotia Energy Research & Development Forum



Every two years, OEER partners with OETR, the Nova Scotia Department of Energy and others, to hold the Nova Scotia Energy Research & Development Forum.

The forum began in 2004 with the theme of **Energy • Innovation • Opportunity**. The forum was held again in 2006 and 2008 with themes of **Partnership • Inspiration • Sustainability and Securing Nova Scotia's Energy Future: Research • Resources • Results** respectively. These forums, held at St. FX University, brought together delegates representing research, industry and government to discuss ongoing research, and how it will shape Nova Scotia's energy future.

The most recent forum was held May 26 and 27, 2010 at the World Trade & Convention Centre in Halifax, Nova Scotia. This theme was **Inspiring Energy Research Opportunities and Capabilities** which focused on ground-breaking energy research that began since the 2008 forum. Over 50 speakers made presentations in the areas of Marine Energy and the Environment, Renewable and Sustainable Energy, Play Fairway Analysis and Geoscience Data Package Program, and Petroleum Geoscience: Offshore and Onshore Nova Scotia. These session topics provided a unique opportunity for open discussion about R&D activity and opportunities, energy

issues, industry needs and the challenges facing Nova Scotia's energy sector. An overwhelming response was received from student researchers. As a result, 34 posters were displayed during the Forum and presented to judges. 2010's forum also surpassed previous registration, bringing in 263 delegates.



Your feedback is always important to us. We invite you and anyone you think would be interested to join our OETR contact list. You can do so by visiting our website at [offshoreenergyresearch.ca](http://offshoreenergyresearch.ca) and clicking on "Register" or by emailing the address below. Please include your contact information, email address, and area of interest.

As a member of the OETR contact list you will be kept up-to-date on OETR news and events.



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