



**Report on
Nova Scotia's Energy Research and Development Forum 2004
May 13-14, 2004, Antigonish, Nova Scotia**

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Executive Summary

On May 13 and 14, 2004, Nova Scotia's Energy Research and Development Forum was held at St. Francis Xavier University in Antigonish, Nova Scotia. The event was in response to the Nova Scotia Department of Energy's 2001 Energy Strategy which set out specific objectives related to enhancing the province's research and development (R&D) capacity in key energy sectors, to establish a higher degree of partnership between various stakeholders for the purpose of strengthening R&D, and to encourage growth as a knowledge and innovation-based economy.

Petroleum Research Atlantic Canada (PRAC) was contracted to organize and deliver the two-day Forum and this was accomplished with the financial and moral support of a number of participants including the Nova Scotia Department of Energy, the Nova Scotia Office of Economic Development and the Atlantic Canada Opportunities Agency. Various corporate sponsors as well as generous in-kind support from St. Francis Xavier University made it possible to hold the event in excellent surroundings, and enable several speakers and students to attend who otherwise might not have been able.

The Forum was structured and the program designed to provide a unique opportunity whereby representatives from academia, government and industry could engage in discussion about R&D activity, energy issues and industry needs, opportunities for relevant R&D and some of the challenges facing not just conducting research, but more specifically about getting the results of research out to where it is needed (i.e. commercialization). Although it was not expected that any major obstacles would be overcome, it was hoped that the Forum would result in a greater understanding of Nova Scotia's energy R&D needs and specific strengths, to open dialogue on how to stimulate research activities and to provide a foundation from which to develop a provincial research and development strategy that will create a sustained energy industry.

Over the course of the two days, approximately 58 speakers from three Atlantic Canada provinces, Ontario, Alberta and one from the United Kingdom talked about their work and perspectives on energy R&D. Speakers ranged from corporate executives and government representatives speaking on how R&D can and should benefit business development and the provincial economy, to how institutions are doing their part to coordinate and conduct research in a number of areas. This was accomplished through a series of plenary and panel sessions as well as three workshops, each running three concurrent sessions on specific industry/research issues. The focus of these was on oil and gas exploration and production, energy use and the environmental impact of the energy industry on the ocean. The first panel discussion emphasized how universities in Nova Scotia are concentrating their efforts on relevant energy issues either through real or virtual centres of research. The second panel ended the Forum with presentations on how the different sectors (academia, industry and government) view the challenges and opportunities for moving research out of the laboratory and into the marketplace.

It is apparent from the diversity of expertise present at the Forum that Nova Scotia researchers, although relatively few in number, are covering a broad range of issues.

More specifically, there appears to be strength in a few key areas including geosciences (improving knowledge of petroleum systems and exploration success) and understanding the impact that the energy sector has on the ocean environment and climate change. Although there is a considerable amount of research being done in many fields it would seem that not enough is being done to link researchers with industry's needs on a global scale. This is important not only for the growth of Nova Scotia's research community, but for placing Nova Scotia on the map as a viable and competitive place to conduct business and innovation.

By all accounts the Forum was a tremendous success. Participants who evaluated its structure, content and logistics indicated that it was an excellent opportunity to learn more of what the research community is doing, and to discuss what needs to be done to move the research and development agenda forward. The Forum is seen as a beginning, and it is anticipated that a second event of this nature will take place within the next two years. At that time further discussion can be held on similar research issues, and to look at what progress might be made in the interim on achieving the objectives of Nova Scotia's energy research and development strategy. Other issues around energy policy research will be considered for inclusion as well. In the interim, the Forum has prompted the Nova Scotia Department of Energy to establish an ad hoc energy R&D network that it hopes will continue the dialogue between supporters of research in such areas as oil and gas exploration, energy production, the environment, socio-economic issues and alternative/renewable energy sources.

1. Introduction

The Nova Scotia Energy Research and Development Forum (Forum) was a two-day event held in May 2004 at the Keating Millennium Centre in Antigonish, Nova Scotia. Arising from the province's interest in enhancing its involvement with energy research and development (R&D), and through a general interest in the wide variety of research taking place in the province, the Forum called upon representatives from academia, government and industry to come together to discuss energy R&D activity, challenges and opportunities in Nova Scotia.

The purpose of this report is to provide an overview of how the Forum evolved from concept to reality. Included in the report are background information on the development and management of the Forum, a summary of session presentations, discussion about an evaluation of its success, and recommendations for next steps. Additional information is attached in the appendices.

2. Background

In 2003, Petroleum Research Atlantic Canada was contracted by the Nova Scotia Department of Energy, the Office of Economic Development and the Atlantic Canada Opportunities Agency to develop and populate a database of information about energy research expertise in the province. A supplementary element of this project was delivery of a Forum that would focus on discussion about research represented in the database. As the name of the database suggests, it covers energy research and development as a whole, and not any one aspect of the energy industry.

It is estimated that roughly 170 researchers in Nova Scotia are engaged in energy-related research and development activities in universities, colleges, government research facilities and the private sector. This may or may not include those with expertise in complementary fields generating knowledge and innovation that can be applied to the energy sector, and that are not typically associated with this type of research. Energy research covers a broad spectrum that includes earth sciences, environment, marine and biological studies, engineering, chemistry, data acquisition and processing, economics, social sciences, law, business, public policy and possibly more. The bulk of this research is funded either directly or indirectly by governments, particularly at the federal level. Relatively little research is funded or carried out by industry or the private sector.

Nova Scotia's 2001 Energy Strategy established three objectives specific to energy research and development:

- To enhance the province's research base so that it has the capacity to support Nova Scotia's emerging oil and gas sector, develop new approaches to its traditional coal sector, and guide it through the eventual transition to an energy economy based on renewable resources
- To create university/college-private sector-government partnerships that will strengthen energy-sector research and development, and help multiply provincial funding with private and federal research money

- To create a culture shift in Nova Scotia toward a knowledge and innovation-based economy through enhanced research and development in energy

With this in mind, the Nova Scotia Department of Energy, the Atlantic Canada Opportunities Agency and Petroleum Research Atlantic Canada cooperated to develop Nova Scotia's first Energy Research and Development Forum.

The purposes of the Forum were to:

- Help facilitate a better understanding of Nova Scotia energy research needs and the specific research strengths and capabilities that exist within the energy research community, particularly Nova Scotia's, that can address those needs and support achievement of the province's energy objectives
- Enable researchers, various segments of the energy industry and governments to discuss issues and consider mechanisms that could help to stimulate increased research activities that are focused, coordinated, clearly positioned within the innovation continuum and directed towards defined needs or opportunities
- Provide the basis for developing an energy research and development strategy for the province that will support the development of a sustainable provincial energy industry in a manner that respects the environment and efficiently meets energy demands

Forum planning was guided by a steering committee comprised of thirteen members from government, academia and industry (as well as PRAC) who advised on development of the program and overall structure of the agenda. The committee was chaired by a member from the Nova Scotia Department of Energy. Although planning and organization were overall the responsibility of PRAC staff, support was drawn from three individuals on the steering committee (technical chairs) that were responsible for designing program content and arranging speakers for their respective sessions during three workshops. Representatives from the Nova Scotia Department of Energy coordinated communications and assisted with some logistical arrangements as well.

Based on an early recommendation by the steering committee the Forum was held at the Keating Millennium Centre at St. Francis Xavier University. One reason for this decision was the desire to select a location other than Halifax, where most events of this nature are typically held. As well, it was felt that although the vast majority of participants would be from the Halifax area, moving them to a location away from home or office would provide for less distraction and therefore greater interaction and discussion over the course of the two days. The Millennium Centre is a relatively new facility determined to be well-suited to meet the needs of a large event such as this.

Major funding for the Forum was provided by the Nova Scotia Department of Energy, the Office of Economic Development and the Atlantic Canada Opportunities Agency, through the province's Economic Diversification Agreement. Petroleum Research Atlantic Canada (PRAC) was contracted to manage the Forum, however it also provided in-kind sponsorship by way of additional staff time devoted to organization, delivery and on-site management during the event. Further sponsorship in the amount of \$4,700 (not

including an additional contribution of \$5000 from the Department of Energy) was generously provided by several companies and organizations. Sponsors' money was used to offset certain venue costs and more particularly to pay for registration and accommodations of up to 30 students, without which they would likely not have been able to attend. For a list of sponsors see Appendix A.

The Forum budget was on the order of \$55,000. This included all expenses for such items as venues, catering, speakers who required financial support, student sponsorship, security, a donation on behalf of speakers to a local charity and a fee for PRAC's services. Revenues were generated by federal and provincial donations, registrant fees and corporate sponsorship.

Information about the Forum was provided almost entirely on a portal within the Energy R&D Database website (www.energyresearch.ca/forum2004). In addition to program details, logistics and information about the Millennium Centre, the website was used as the primary means of registration for delegates.

3. Structure

The Energy R&D Forum is believed to be the first of its kind in the region where an opportunity was created to shift the focus on research and development from one sector within the energy industry, to a broader view of energy as a whole. As well, the Forum was not intended to be strictly a technical symposium where speakers would present results of their research, but rather to hear about research initiatives, challenges and opportunities for Nova Scotia's energy industry and the research and development community, and to encourage dialogue between different interest groups.

Because the scope of the Forum was broad, so too was the range of speaker expertise. This was due in part to careful planning of the program and targeting individuals whose experience could best complement the objectives of the Forum. Presentations were made by researchers from almost all academic and government research institutions throughout Nova Scotia, several industry companies active in Atlantic Canada and members from both provincial and federal levels of government. Not all speakers were from Nova Scotia. Newfoundland, Ontario and Alberta were represented, and one speaker attended from the United Kingdom.

It was hoped that such a program would attract an equally diverse cross-section of attendees. Efforts were made to ensure that information about the Forum was broadcast to as many different groups and individuals as possible, and this was accomplished through notices sent via email, briefs posted on the OTANS/NOIA bulletin, mail-out of a brochure and personal phone calls.

The program itself was designed to look at some of the energy research and development that is taking place in Nova Scotia, and some different perspectives on challenges and opportunities facing industry and the R&D community. This was accomplished through

a mixture of plenary addresses, panel sessions and concurrent workshops with speakers from industry, government and academia.

The first day opened with a speech by Chris Huskilson, COO of Emera Inc. who effectively set the stage for the Forum by citing examples of where innovation has successfully overcome past challenges, and speaking about how Nova Scotia's research and development community has "great opportunities to develop the energy of the future" through new research initiatives.

Following Mr. Huskilson a panel session was held with presentations from the five major universities in Nova Scotia and Petroleum Research Atlantic Canada speaking about how they are focusing their attention on energy research and development through the establishment of virtual centers of excellence such as Energy at Dalhousie, or construction of new laboratories and facilities such as the Centre for Applied Petroleum Sciences at St. Francis Xavier University.

The majority of presentations both days centred around three workshops divided into three concurrent sessions focusing on oil and gas, energy use, and energy and the ocean environment. Within the oil and gas framework, sessions focused on: Deepwater Nova Scotia, Linking Data with Knowledge and Risk. Energy Use looked at: Supply Choices, Demand-side Management and Climate Change. The Energy & Ocean Environment sessions included a range of complementary subject material. A full program is attached as Appendix B. The purpose of these sessions was to provide researchers with an opportunity to talk about some of the current work they are doing, to offer suggestions of where they see some of the research and development challenges and to engage the audience in dialogue about research and development issues.

The second day opened with remarks from Ms. Debbie Windsor, Director General, Business Development with the Atlantic Canada Opportunities Agency. Her speech focused on the importance of research and in particular, getting results into the marketplace where it is needed. This was followed by a presentation by Mr. Graham Campbell, Director General, Office of Energy Research and Development with Natural Resources Canada. He spoke about what his department's strategy and focus are toward energy research, some of the challenges facing the energy research sector, and offered some suggestions for improvement.

A final panel session was given on some of the challenges and opportunities facing the commercialization of research, as seen from the perspective of members from academia, government and industry. This session was viewed as an excellent way to round out the discussion from the previous day and a half on why research and development is important and the kind of research that is being done right now, by discussing how easy or difficult it is to get research out of the laboratory and into the "field" where it can be applied to real-world needs.

An extension of the program (not originally included in the agenda) was a poster session held throughout the two days. This was added for the purpose of offering attendees an

additional choice of research material to view, but perhaps more significantly to act as a catalyst to encourage students to attend the Forum and to present themselves as the future generation of energy researchers. In all, 26 posters were given under the same three themes as described above, 20 from students and six from academic and corporate researchers.

4. Overview of Sessions

Following is a brief summary of the presentations given during the three technical workshops:

Day 1

Opening Remarks

Mr. Dan McFadyen, Deputy Minister of Energy for the province of Nova Scotia opened the first day of the Forum by providing a brief overview of the role his department plays in contributing to research and development, creation of knowledge and bringing people together to meet research needs and contribute to global issues. Mr. McFadyen spoke of the shared commitment and partnerships that exist between academia and the private sector. He reminded the audience that energy is more than just science; it includes social sciences, economics, law, business and other studies, all of which shape the future of energy.

First Plenary

Mr. Chris Huskilson, COO of Emera Inc. spoke to the Forum on the subject of research and development needs in Atlantic Canada, and what can be done to respond to those needs. Whereas many people believe the energy industry is in a crisis, when conditions change, instead of seeing crisis we should be looking at the opportunities that change presents. High gas prices provide incentive for more offshore exploration activity; environmental concerns and reduced fossil fuel supplies can lead to thinking about improved energy production and consumption as well as using alternative energy sources.

These factors lead to the need for more research. There are many examples of how research and development pays off in the energy business: finding ways to extract fuels from unconventional sources (i.e. Alberta tar sands); improving power production efficiency (Point Aconi power plant is Emera's lowest cost unit); utilizing alternative energy sources such as wind to supplement power generation. Supplies of coal are believed to be considerably higher than crude oil or natural gas, however although it is easy to burn coal, it needs to be done more cleanly. Hundreds of millions of dollars are being spent on research into clean coal technology (how to do it and what to do with the waste CO₂).

Emera is currently supporting three areas of research: sequestration of CO₂; carbon gasification and development of wind turbine technology. All of these can lead to

significant application in industry. As a business it makes sense to look for the most economic and efficient means of producing energy.

Panel Session – Energy Research: A Concentrated Approach

This panel was designed to demonstrate how various institutions in the province are concentrating their efforts on energy research and development through the establishment of either real or virtual “centres of excellence.” Presentations were as follows:

- St. Francis Xavier University has established the Centre for Applied Petroleum Sciences (situated in the new science complex) for the purpose of conducting research and development in four key areas: surfactants and colloids – these have useful applications in the development of drilling fluids; biomechanics under the ocean – how do pipelines affect lobsters and snow crab; biofilms – the most prolific biomaterial on the planet but they can cause damage by corrosion; and, high-performance computing – enables powerful simulation of conditions that cannot be performed experimentally
- Dalhousie University has created a virtual centre of excellence with a team of researchers who are focusing on a number of energy-related issues. “Energy at Dalhousie’s” mission is to provide education and conduct inter-disciplinary research into conventional and alternative energy and their impact on the environment, climate and society. Fields of interest include: exploration and production; processing, transportation, distribution and utilization; law, public policy and society; data mining and visualization; environment and climate change; alternative energy; health and safety; and, risk management.
- Saint Mary’s University does not have a “centre of excellence” in energy research per se, however there a number of departments conducting energy-related research. Examples include: psychology – evaluation of human psychology and safety; chemistry of ionic fluids – extracting H₂S from natural gas; commerce – implications of policy and regulations; geology – understanding petroleum systems sediment delivery (offshore and onshore).
- Acadia University’s Centre for Estuarine Research conducts energy-related environmental research in coastal waters, especially the Bay of Fundy where tidal power is a significant topic for study. Tidal power remains an option if non-barrier designs are used (those that inhibit fish mobility). If dams can be avoided, so can the more negative consequences to fish. Energy projects always have an environmental impact. Research is important to help determine these and how to manage them. The Centre’s work is largely scientific but also includes focus on community based integrated coastal management.
- The University College of Cape Breton (UCCB) is proactively focusing on many aspects of petroleum research and development. UCCB recognized the potential opportunities in the energy sector for Atlantic Canada in 1998 and moved forward systematically to achieve a three-pronged approach for development: technology transfer; education and training; and, applied research. Many of UCCB’s research and development activities are in support of the local, regional, national and international oil and gas industry sectors. During 2003, UCCB was successful in establishing a Canada Research Chair in Integrative Science and has

been awarded an Atlantic Innovation Fund project called “Petroleum Applications of Wireless Systems.”

- Petroleum Research Atlantic Canada (PRAC) is a federally incorporated, not-for-profit organization with a mandate to facilitate and fund inter-disciplinary research and development related to oil and gas, and the diffusion of that knowledge. Over three million of PRAC’s membership dollars have been directed toward petroleum research since 1999, leveraging roughly \$13 million from other sources. Through a comprehensive review process, over 30 projects are underway in fields related to: engineering, natural and social sciences, environment, public policy and socio-economics, and human resources, education and training. In addition to its primary role, PRAC has developed Nova Scotia’s Energy Research and Development Website and Database, a detailed, searchable compilation of information about who the energy research experts are in the province of Nova Scotia and the work they are doing.

Workshop 1

Session 1 – Oil and Gas: Deepwater Nova Scotia

This session focused on Nova Scotia’s deepwater environment where expectations for further growth in activity have increased. Presentations were given on:

- Opportunities – wells are getting deeper, geology looks good and there is optimism in the boardroom (large work commitments, close proximity to energy market, Laurentian Sub-basin boundary resolved). Challenges include: distance to shore; physically harsh environment; geohazards; competition with global jurisdictions; cost of doing business; regulations and research.
- Hydrocarbon risk assessment must continue. There are many geologic play types but not enough is known about the reservoirs and their sources. A lot of work has been done, however more is needed to understand where the hydrocarbons are coming from and going to. Not enough homework and modeling is being done before drilling occurs.
- The Scotian slope exhibits evidence of mass failures. Geomechanical testing is being conducted on shallow surface samples. Trigger mechanisms need to be further researched. It is known that glaciers are not a cause, but gas hydrates and movement of gas needs to be studied.
- Research is being conducted on gas hydrates at the molecular level. Crystal growth and attraction of methane to crystal interfaces is being studied. It is difficult to simulate and therefore predict hydrate crystal growth. Questions exist around what happens to methane in the presence of water and ice at the microscopic level.
- Current published literature reflects a relatively poor understanding of salt in the Scotian basin because most information comes from seismic data. There appears to be three hydrocarbon play types, all related to the presence of salt, but the geology is complex. Salt can migrate vast distances rendering the search for hydrocarbon very difficult. A better understanding of salt movement and its impact on hydrocarbon placement is required.

Session 2 – Energy Use: Supply Choices

This session was designed to look at the different energy supply choices that are, or could be available, with particular emphasis on non-fossil fuel sources. Presentations focused on:

- There are differing views of energy supply: one is that change is not required because problems are not too bad; and secondly, that change is advisable. There are many reasons to improve technology and look for alternate sources to fossil fuels: security of supply, need to leave something for future generations, environmental concerns and cost. Reduction strategies include: using less energy, using renewable energy sources, using cleaner, low carbon fossil fuels. Several suggestions were made: wind; hydro-electricity; biofuels; wood; solar; harbour cooling and geothermal energy. The conclusion is that the future looks bright for low carbon energy sources.
- Fuel cells are a viable alternative fuel source. They are not commercially popular but they have many useful applications. Fuel cells require hydrogen or methanol as a source, but the only emission is water. Dalhousie University is conducting research in fuel cells right now. They see huge potential for economic returns through this kind of research. Although some corporate sector funding is available, more private and public funding is required.
- A two-phase study is underway by the Canadian Clean Power Coalition for the purpose of demonstrating that coal-fired electricity generation can effectively address all environmental issues projected in the future, including CO₂. Cleaning, utilization and storage of CO₂ as well as related costs are elements of the study. Among the many conclusions of Phase I are that emissions from coal can be reduced to that of natural gas, and though costs are still high, there appear to be many opportunities for this kind of technology. Phase II of the study is addressing such issues as technology advancements and gaps, and reducing costs.
- Unconventional fuels such as wind power are key to addressing issues related to increased demand for electricity, rising fuel costs and greenhouse gas emissions. The price of wind power is dropping and the greatest demand for energy comes when wind power is higher (winter), however there are some challenges: seeing turbines on the landscape, wind is inconsistent and power generation does not always match demand, environmental concerns about nesting birds. Alternate choices include biomass which can be sourced from agriculture, forestry and others. Biomass has low sulphur output and costs are not too high. The real solution could be a combination of both wind and biomass where one source can support the other. There are some technological barriers and more research needs to be done on this strategy.
- Solar energy is a viable option for many regions. Use of solar energy has been around for many years and although it cannot replace existing sources, it can supplement them. Solar energy remains a costly venture, however it is a viable option for locations where power grids are not well-established.

Session 3 – Energy and the Ocean Environment

Presentations were given on several key environmental issues related to:

- Reducing environmental risk through early planning – two types of commitment: compliance (an obligation to follow regulations) and voluntary (pro-active commitment to the environment). Ideally companies should strive for a Best Practice approach by taking a systematic look at all aspects of a project and determining the best practice for each stage. Getting everyone involved in the early stages of planning is key. Use a risk assessment scale to look at how people, the environment, company assets and its reputation will be affected by what is done. Benefits of early planning include: minimize environmental “footprint,” reduce costs, increase regulatory efficiency and goodwill in the public eye.
- Certain areas of the Scotian shelf are vulnerable to disturbances in part because marine growth including coral reefs are highly susceptible to damage. Damage to reefs can affect other species of marine life. Preservation of the reefs is essential to protect those and other species. Coral reefs are quite abundant in cold waters and offshore Nova Scotia there are three areas in particular. Each site is recognized and active conservation programs are in place. Canada’s Oceans Act (1997) is based on three core principles: sustainable development, integrated management and a precautionary approach. In order to plan for Marine Protected Areas, research is necessary. Understanding habitat diversity can lead to protection of individual parts that affect one another. The speaker cited crises in the fishing sector where conservation has always been an afterthought. Early planning is essential.
- Early planning for environmental assessments is very important and taking a “cradle to grave” approach is key to understanding what the potential issues are as well as possible solutions. Making the best use of available data is required. Information such as what is found through whale observations during offshore oil and gas exploration has increased, but there is a need for these data to be analysed. Regulatory review of data should be mandated for the purpose of identifying impacts and proposing mitigation strategies.
- For many years, studies have been done on the affects of drilling wastes on fish stocks and the marine environment. Moratoria such as on Georges Bank are often due to concerns about toxic effects of waste. Studies have been done on particle sizes of some drilling muds and how they disperse over time from where they are deposited. Results are not always as expected.
- Environmental Effects Monitoring (EEM), Ecological Risk Assessment (ERA) and Ecosystem Health Assessment (EHA) are three ways in which the offshore is regulated and monitored on behalf of government and industry. EEM and ERA complement each other. There are many techniques used for monitoring in the field and resultant data can be fed into an estimate of risk. EHA enables the focus to be not on individual species and populations, but on the ecosystem as a whole. EEM is a very active field of study with many new advances in technology and innovation. A strong basic and applied research effort must be maintained as the backbone of EEM in coastal and offshore waters in Nova Scotia.

Workshop 2

Session 1 – Oil and Gas: Linking Data with Knowledge

This session emphasized the importance of acquiring, accessing and using environmental, geological and geophysical data in a cost-effective and timely manner through the use of advanced instrumentation and management techniques.

Speakers presented some of the difficulties currently encountered when working with data including (but not necessarily limited to):

- Geographical and environmental obstacles present challenges to marine data collection. Vast areas and water depths, seasonal conditions etc. require different acquisition techniques and although costs have come down, it is still a very expensive proposition. Emerging interests have led to technical advances including ROV's, Internet and satellites which make data collection easier, but increased transmission speed, more reliable power supplies and automation is required.
- Volumes of seismic data collected over time are huge. This is costly, not only during collection, but in transmission and processing. There is a need to update data, and if costs can be reduced the probability of research increases. One solution is a geostationary view of the earth's surface which allows for vast amounts of data upload and download. The offshore oil and gas industry has a need for cost effective data transmission from ships to data facilities.
- Data collection for seismic and drilling operations is very expensive due to technology and the environment in which it is collected. Currently it is the offshore regulator (offshore petroleum boards) who manage the data. There must be a balance between who pays for the data and the broader interests of industry as a whole. Data has commercial interest; earlier access to data can reduce costs (a fair proposal). Decades of archived data have made it easier (less costly) for smaller companies to get involved in the offshore industry. This facilitates more research which in turn makes Nova Scotia more competitive.
- Visualization of mined data is interesting, but not much has been done in this field yet. This can lead to more opportunities for research. Data are facts, but knowledge is the result of putting the data to use. Data mining involves finding patterns in data and using inductive techniques.
- There are many myths surrounding data visualization: visualization is not necessary; visualization is not real work; and, people use visualization a lot. Despite these myths there are a number of examples that suggest otherwise. Stock market graphics and seismic mapping show that visualization can be necessary and that almost anyone can interpret visual data. Most people are still working in one dimension and adoption of visualization techniques is low (academics could play a larger role in educating people how to use this technology). Although it might be thought that people use visualization a lot, this is not necessarily the case. Another example of the utility of visualization is in determining a location to drill a gas well through seismic interpretation. Visualization can reduce this process from three to four weeks to a little as two

hours. There is a business case now for using visualization: resources are harder to find; visual interpretation has implications; data volumes are increasing; and, advances in audio-visual technology are reducing visualization costs. In the future, visualization will get easier. It is for everyone including beginners.

Session 2 – Energy Use: Demand Side Management

Presentations were given on the concepts and applications of managing demand and supply of power. Specific topics included:

- Management strategies for increasing energy efficiency include evaluating organizational and behavioural competencies, not just technical concepts. Few people understand how power is paid for. Demand-side and energy management can lead to: improved system reliability and productivity, and providing the user with what they want while using less energy. Energy management requires a holistic approach incorporating an understanding of the cost of energy, comparing with other benchmarks, understanding when and where energy is used, eliminating waste, maximizing efficiency and optimizing supply. It is not a question of ‘what’ creates savings, but ‘who’ sustains savings.
- Load shaping is the process whereby electrical usage is modified for the purpose of benefiting the utility system as a whole. This is an effective form of Demand-Side Management (DSM) which can result in reduced utility operating costs and deferring the need to add generation capacity. Load shaping rates are complex to develop and require specialized expertise, however load shaping rates are not available to most customers, particularly in smaller markets such as Nova Scotia. In the absence of initiatives by the utility, the opportunity may exist for capable third parties to research and design rates that support DSM programs. As universities become involved in energy market research, the design of workable load shaping rates could become an effective adjunct to promote efficient generation and use of electricity.
- Given that someday the world’s oil supplies will eventually become cost-prohibitive to extract, there is a need to develop energy alternatives. Incentives are provided in Nova Scotia to increase energy efficiency through such methods as revitalizing old, inefficient buildings through new technologies, and utilizing new construction techniques and alternative energy sources (ex. solar and wind) to reduce greenhouse gas emissions. Barriers do exist: lack of in-house expertise, staff and fiscal resources, but there are many simple methods that can be used to improve energy efficiency.
- Demand-side Management (DSM) is essentially the managing of utility load shapes for the benefit of utilities and customers. Utilities need to understand how to get the best value out of modifying load shape. Some factors to consider include: objectives of load shaping, identify alternatives, analyze program performance options, implementing programs and refining over time. Research is crucial for DSM. Types of research include: technical research – what technological options are available and how much do they cost; market research – end-use surveys, distributor feedback.

Session 3 – Energy and the Ocean Environment

This session focused on environmental impacts and affects of offshore activity:

- Experience has shown that there is a need for environmental impact research in cooperation with industry activity. Some surveys have been conducted providing valuable information about such things as how cuttings are distributed on the seabed. Deep sea surveys are costly, requiring materials, equipment, vessels and a reasonable sample area. There is a reluctance to perform some of this work “in our backyard,” however there is similar resistance to accepting evidence from other regions. Environmental assessment can often migrate from scientific fact to emotion.
- Produced water is the largest waste stream from oil and gas production. It contains quantities of formation water, injection water and treatment chemicals that can be toxic to the benthic environment. A key question is will this become more of a concern in the future as proximity and number of wells increases? There is a rationale to identify impacts and ways to minimize them. This can be accomplished in part by: field sampling of trace metals and naturally occurring radioactive materials, conducting environmental impact assessments, prediction of risk and defining project deliverables such as models, ecological risk assessments and policy revisions.
- Public perception of offshore oil and gas development focuses concerns over this activity on fisheries and the environment. Although studies suggest that offshore impacts over the life of a project should be minimal, chronic toxicity potential of production waters warrants further attention, if only to confirm this. Timely advice on any potential for tainting of fisheries resources is essential. Environmental Effects Monitoring programs should emphasize determination of impacts on fish health and fish quality, as well as on sediment quality and plankton communities. Other issues requiring further investigation are: seismic activity (what are exposure distance relationships for producing sub-lethal damaging effects in organisms?); oil spill dispersants can reduce environmental risks, but are they being unnecessarily fettered for use under the regulatory provisions of the *Fisheries Act*.
- Minimizing and mitigating the potential effect of sound upon the environment is an increasing concern for the oil and gas industry. Seismic surveying, drilling, offshore structure removal and associated production and support activities all create underwater noise. Propagation models utilize bathymetric databases, geoacoustic information, oceanographic parameters and boundary roughness models to produce estimates of the acoustic field at any point far from the source. Sound propagation models coupled with accurate source and receiver models provide invaluable tools for predicting impacts from different operational scenarios and environmental conditions.
- The potential impact of seismic sound on marine mammals has only really become a concern in the last 15 years. Sounds produced during seismic surveys have the potential to produce behavioural and/or physiological effects on marine mammals. It is difficult to know if these effects are biologically significant in terms of the survival of a marine mammal stock or population. Major information gaps exist in issues such as descriptions of acoustic characteristics of marine areas, and in propagation models for seismic sounds. These gaps result in

a high degree of uncertainty in the impacts of seismic operations, and as such a precautionary approach to regulation is required and baseline research is critical. A study in 2003 in the Sable Gully showed that seismic activity did not adversely affect the number of animals in the area, there appeared to be no variance in behaviour during normal and seismic operations, and animals can hear seismic sound as far away as 80km from source.

Day 2

Opening Remarks

Ms. Debbie Windsor, Director General, Business Development with the Atlantic Canada Opportunities Agency (ACOA) opened the second day of the Forum with a speech about the importance of continuing the discussion on energy research. It is very easy to take energy and electricity for granted until the power goes out or price increases. A balance must be maintained between energy, the environment and the economy. Research and development is key to sustainability, competitiveness and growth in Atlantic Canada. Significant money has been invested in energy R&D in the region by ACOA and others, but research results need to be transferred to the private sector. It is essential that research is brought out of the laboratory and into the market. Through partnerships such as between ACOA, the Nova Scotia Department of Energy and Petroleum Research Atlantic Canada, R&D capacity can be enhanced.

Second Plenary

Mr. Graham Campbell, Director General, Office of Energy Research and Development, Natural Resources Canada spoke about his department's role in encouraging and supporting energy research and development. The primary goal is sustainable resource development with a focus on three components: environment, economy and social responsibility. R&D is needed to provide a knowledge-base for decision-making, to shape emerging policies, bring forward new solutions and make expertise and facilities available. NRCan works on four main themes: sustainable resource development, reliance on market mechanisms, focused interventions, and partnerships. Key research areas include: offshore oil and gas, wind energy (improved design, optimized performance), demand-side management, clean coal technology (CO₂ capture and storage, emissions, combustion efficiency), and responsible use of fossil fuels.

Lessons learned about innovation revolve around taking the knowledge gained and putting it to work in practical, concrete ways. Government's role is to look after the public good and focus on commercialization; industry is focused on market share, competition and survival; and universities are primarily interested in longer term search for knowledge. There needs to be a balance between these different agendas. There is a need to address a perceived critical gap between research and development activities and commercialization (the "valley of death"), to strengthen collaboration between industry, government and academia, and to focus on key niche areas that are important to Canada. This can be accomplished through increasing technology capacity, innovation, and

recognition of the roles each party must play. Organizations such as ACOA and PRAC have an important mandate to play in developing Atlantic Canada as an emerging energy frontier.

There are many challenges: fragmentation and duplication, decreased funding, complexity of programs and determining where the focus of R&D should be. Emphasis needs to be placed on innovation (a broader framework) rather than just R&D. When developing an R&D/Innovation Strategy for Nova Scotia, consideration must be given to the level of participation that governments take in technology development (direct investment, partnership, source out, or maintain a watch on it). Strong partnerships need to be established and they should take a multi-disciplinary approach rather than working on a piecemeal basis. Work must be done to focus priorities. Nova Scotia needs more commercialization. Sustainable partnerships with a focus on international opportunities will help.

Workshop 3

Session 1 – Oil & Gas: Risk

The focus of this session was on various kinds of risk management associated with oil and gas exploration, development, production and marketing. Some of the factors that need to be considered include:

- Weighing risk of a project's success against the uncertainty of how profitable it will be – in many respects this is a matter of properly estimating reserves and reassessing over time as production declines. There is a need to educate people on the differences between these issues and the implications they can have on running a business such as an exploration and production company
- Managing safety within an organization and its operations at the worker level by bringing risk factors to their attention and including them in the process of implementing safety practices. The bottom line is safety can better be controlled through increased awareness at the frontline level
- Balancing risk with regulations and closing the gap between legislation and how objectives are going to be fulfilled. Can regulatory risk be reduced by limiting the number of regulatory stakeholders to one, and does performance-based regulation make sense for Nova Scotia's offshore environment? We can use other jurisdictions such as Norway as a benchmark, but does that model work and is it a good fit for this region?
- When considering the financial aspects of risk (example – hedging future sale price of natural gas) there are three main strategies to follow: "Do nothing," (sell at whatever the market price happens to be at the time), Forward (enter into a contract to sell at a preset price at a preset time) and Option (gives the right but not the obligation to sell at a preset price and time). Hedging natural gas price incorporates many risk factors and philosophies. It takes a strong appreciation for the market with the knowledge that mistakes can be very costly.

Session 2 – Energy Use: Climate Change

This session focused on various aspects of climate change including the science behind it, planning for adaptation and potential impacts of climate change on the energy sector.

- Modeling is extensively used to understand how climate changes and to determine if global warming is a natural phenomenon. There is a tight relation between temperature and CO₂. The most significant increase in temperature has been in the last 10 to 20 years – most likely due to increased use of fossil fuels. In addition to temperature increases, sea level has risen due melting of the ice cap, and moisture content in the atmosphere has increased. Computer technology needs to advance to be able to more accurately model and predict climate change.
- By looking at natural global trends, the earth should be experiencing a cooling phase rather than warming, so global warming must not be a natural event. Predictions for the next 100 years suggest further increases in temperature, sea level rise, variations in climate, more natural disasters and increased erosion. Adaptation to climate change is necessary even if methods of mitigation and prevention are determined. It is necessary to accept that climate change is happening and development of adaptation strategies is essential: recognize adaptation planning and undertake vulnerability assessments. Government and private sectors need to work together on this.
- Global warming can impact the energy sector through changes in precipitation – less water runoff reduces capacity for hydroelectric power. Additionally it is predicted that over the next 30 years there will be a 10% decline in average wind speed in Nova Scotia (from levels during previous 30 years) which could reduce reliability on wind power. Warmer oceans can lead to increased storm activity and therefore increased threat to offshore oil and gas structures. Many harmful occurrences are becoming more variable and less predictable. Adaptation to unpredictable changes is necessary. More research is required to handle variability, extreme events and threats.

Session 3 – Energy and the Ocean Environment

This session focused on some of the technological advances and research that is focused on environmental issues related to the energy sector.

- Technological advances in seismic testing are reducing the impact on the environment by various methods that decrease ship time and reduce potential harmful affects on marine life. Studies have been done that show seismic surveys do not harm fish. More harm is caused by research studies – research should be done but not unnecessarily.
- Geomatics is a discipline using technologies of remote sensing, global positioning and geographic information systems. Through mapping and modeling, this technology can be used to determine where the best location might be to position a wind farm for power generation. Data can be generated to determine where the potential for flood risk exists.
- Biofilms affect us in many ways. They are found everywhere, survive almost anything, are difficult to control and can cause such things as metal corrosion.

Biofilms are affected by fluid flow and this needs to be studied further. Work is currently being done on the chemistry of biofilms but more needs to be done to control them.

- Prediction of wind and wave intensity is important, as was demonstrated during Hurricane Juan in 2003. Forecasters need the right information in order to issue the right warnings. Accurate modeling is necessary to be able to evaluate risk to such things as offshore oil and gas platforms, as errors of just a few degrees in storm track can have a significant impact on the path of storms.

Panel Session – Linking Research to Application – Opportunities and Challenges

The final session of the Forum brought together individuals from academia, government and industry to speak on various perspectives on the challenges and opportunities that are presented in transferring research from the laboratory to application:

- Current convention is to tie university research with local industry needs in part because governments tend to be territorial. Although this might seem reasonable, it does not work effectively, given today's knowledge economy. There are three aspects of knowledge: research, development and experience. Atlantic Canada does not involve these fully. There are few basic research facilities, few innovative firms and little contact with operations people in experienced companies. Too frequently there is a tendency to forget about the "D" (development) in "R&D." Universities are good at the "R" (research) but not so at the "D." Companies do not necessarily care about the research; they need to apply the development. University professors have little loyalty to universities. They are interested in peer recognition on a global scale however they are expected to focus on local needs. Knowledge goes into a global pool and its source is not important. Atlantic Canada universities have limited access to libraries and more funding needs to go into providing this. Companies are "dredging" the global knowledge pool for innovation however in Canada greater emphasis is placed on research than on development. More development is required and it needs to come from the global knowledge pool. Canadian universities need to be able to add to that pool.
- University professors are driven to be recognized for their work. The objective of research is to publish results. Expectations from government are to see clear outcomes of funded research, however it is not the role of universities to commercialize research. There are two models to describe the translation of knowledge to commercialization: "pull model" – industry has a requirement and seeks results from academia; "push model" – intellectual property (IP) is discovered at the university level and "pushed" out to industry. Ownership of intellectual property is very important and evidence suggests that in Canada it does not matter who owns the IP (university or faculty), the extent of knowledge transfer is comparable. Effective due diligence is required at an early stage to evaluate IP before it is published and to determine whether or not commercial application exists. Universities tend to develop patents however there is very little benefit from this. Challenges facing commercialization of university research include the requirement to focus on education of researchers, adequacy

of management strategies, effective assessment of commercial potential and funding. Most research funding comes from government with far less from industry. This tends to keep the focus of research in universities and government laboratories. Transferring technology out of the lab is a challenge in part due to limited funds to develop proof of concept. Dalhousie University is in the process of reorganizing its process of technology transfer through second generation ideas. This includes the cooperation and unity of Atlantic Canada universities to develop networks.

- Commercialization is a key part of the government of Canada's strategy. This is of particular benefit to existing small and medium enterprises, as well as to the creation of new ones. In Atlantic Canada, most funding for research and development comes from academic institutions and the government (primarily federal). Regionally there are very few firms that focus on research and development. Challenges to commercialization include: lack of industry receptor capacity; gaps exist in R&D dissemination and commercialization capacity (including incubators); limited university/industry liaison; few applied research alliances; and, no science councils. ACOA would like Atlantic Canada to be recognized for its innovative capacity and competitiveness in the global market. Commercialization is a complex process requiring patience, perseverance and collaboration between all stakeholders (academia, private sector, government research facilities, NGO's and government). Most academic research is not driven by market needs. The conditions for industry/academic collaboration need to be improved.
- The energy sector requires a balance between business and technology. InNOVAcorp links academic research (knowledge) with market needs (innovation). Nova Scotia is a very research-intensive province, however little is done after the research has been conducted, to put it to use. There are various stages of growth that a company must go through to become successful, and the different stages require different types of leaders. University professors can lead at the first stage of growth (R&D, creation of intellectual property), but others are needed for successive stages. Successful innovation occurs outside the university, but activities need to be linked together. The energy sector has its own unique challenges and some linkages have been implemented. Making sure R&D activities are closely linked with industry's needs is crucial. This can be accomplished in part through: increased international collaboration; making events such as the Energy R&D Forum an annual event; organizations such as Petroleum Research Atlantic Canada working as catalysts for collaboration; and, focusing commercialization on unique strengths and opportunities.

Closing Remarks

Dr. Sean Riley, President of St. Francis Xavier University closed the Forum by giving thanks to all who participated, and to the sponsors for their generous support. He noted that Atlantic Canada needs to work on research and development and pointed out that it is not easy to develop sustainable business without structure, leadership and collaboration. Entrepreneurship is important, as is relation-building during events such as the Energy R&D Forum. Dr. Riley called upon Andrew Kendall, Industry Liaison Officer to present a \$1000 donation to the Antigonish Food Bank on behalf of all speakers in lieu of individual speaker gifts.

5. Poster Session

The Forum agenda included presentation of technical posters by students and researchers. In all, 26 posters were presented as follows:

- 20 by students from five academic institutions including Dalhousie University, Acadia University, Saint Mary's University, St. Francis Xavier University and Queen's University, Ontario (the latter in cooperation with students from local universities)
- five from academic faculty members from Dalhousie University and St. Francis University
- one from small business

Poster topics covered a wide range of subjects including (but not limited to) mitigation of energy-related environmental aspects, pore pressure prediction, petroleum systems, coalbed methane, renewable energy for Nova Scotia, toxicology of crude oils and biofilms. Although presenters did not attend their posters the entire time, several coffee breaks and a 30-minute time slot on day-two enabled significant opportunity for discussion with authors.

6. Forum Participant Evaluation and Questionnaire

Prior to the close of the Forum, evaluation forms were distributed to all participants for written feedback. The purpose of the evaluation form was to get a sense of what was done well, what could have been improved upon and what perhaps should not have been included in the Forum format. This information will be used in conjunction with other sources of feedback to assist in planning future events of this nature.

Of the roughly 200 evaluation forms offered, 56 (28%) were returned with varying degrees of completion. Questions were in the form of statements about various aspects of the Forum. People were asked to rate their level of agreement with statements selecting from five choices or values (strongly disagree, disagree, neutral, agree and strongly agree).

Results of this line of questioning are presented in Appendix C with the response rate for each value within each statement.

Comments on certain aspects of the Forum were also sought and a general listing of responses is also further presented below.

6a. Summary of Participant Evaluation Results

To a great extent, respondents indicated that the Forum provided useful information about current research and its significance to themselves as well as Nova Scotia. Most people felt the Forum will help define some of the energy research priorities for Nova Scotia, and only 34% were neutral or disagreed that the Forum identified some of the gaps in current energy research initiatives.

Respondents suggested the Forum attracted a good balance of representation from key stakeholder groups (this is supported by registration figures that show an even split between academia, industry and government attendees) and 94% believe they will be able to use some information gained from the Forum in their future energy research and development endeavours. Overall, 92% agreed or strongly agreed that the Forum program was well designed, however several people indicated a level of dissatisfaction with the presentations (too technical, too long, too bureaucratic etc.).

There appeared to be a high degree of satisfaction with the amount of information provided to people in advance of the Forum, and it is suggested that the reception was a valuable part of the overall agenda.

In all, fully 100% of respondents either agreed or strongly agreed that the Forum increased their knowledge of Nova Scotia energy research and development, and everyone indicated they would be interested in attending future Forums similar to this.

A recurring comment from many was that the Forum provided an excellent opportunity for networking in an excellent venue, although many people also commented that there was insufficient opportunity for discussion with speakers following their presentations.

6b. Conclusions from Participant Evaluation

In reviewing the evaluation forms it appears as though the Forum was successful in providing an opportunity for participants to learn more about issues, challenges and opportunities in energy-related research and development in Nova Scotia. Most respondents agreed with each statement, suggesting that for the most part the Forum met people's expectations and provided a satisfactory return on their investment of time and money. It was a rather unique opportunity for people to come together with limited distraction in excellent surroundings to engage in networking and to learn more about issues around energy research and development.

With such a variety of subject matter and diversity of interests among attendees, contradictory opinions regarding different aspects of the Forum abound. However if there is one criticism that should be taken from this it is that many felt there was a lack of

opportunity for discussion with speakers following presentations. This appears to be supported by comments suggesting that certain presentations were not well-suited to some people's expectations, however it might be concluded that had their been time to engage speakers more openly in question and answer periods, attendees might have come away with more of what they were looking for from each presentation.

Despite the lack of adequate time for discussion it is believed that the program format and agenda were well designed, presentations and subject matter were appropriate and the overall Forum management was very good. It has been suggested that the organizers build on the success of this event and hold future Forums within a reasonable time period.

6c. Summary on Online Questionnaire

A second questionnaire was posted on the Forum's Website and participants were asked (by letter and email) to take a few minutes to fill it in online. Questions were directed toward providing organizers with specific ideas of timing, location and content of the next Forum. Of the 212 people who participated in the Forum, 33 (15%) responded to the questionnaire.

A statistical analysis of questionnaire results was not conducted, however there are some conclusions that may be drawn from it:

The next Forum should:

- be regional in focus, not exclusive to Nova Scotia (fully 84% of respondents indicated they are from Nova Scotia)
- include a panel discussion on research and development opportunities
- include concurrent workshop sessions as in 2004
- have increased opportunity for discussion with speakers
- be a two-day event (further consideration should be given to restricting it to 1.5 days)
- likely be held in a location other than Antigonish (possibly Halifax)
- likely be held in the spring of 2006
- see increased participation by industry
- not decrease the volume of technical presentations

On the issue of subject matter for the next Forum there appeared to be some consensus as to where the focus should lie. It would seem that coverage of a broad range of issues appeals to many people, however fewer people would like to focus on oil and gas research than other issues such as the environment, energy use and policy research.

Further validation of certain elements of Forum planning and the program was received:

- evening reception is a good addition to the agenda
- a delegate's dinner should be held
- online registration and information provided through a website is very convenient

Participants were asked whether or not they would be willing to pay an additional \$50 for registration at the next Forum. 56% of respondents indicated they would not be willing to do so and the remaining 44% said they would.

7. Next Steps

Following the successful conclusion of the Forum, organizers and key stakeholders of the event met to discuss their thoughts and feedback from participants on what some of the next steps should be to carry forward from what was learned. Some of the main recommendations include:

- a) Next Forum – it is clear from all accounts that the Forum was an excellent way of bringing people with different interests, perspectives and backgrounds together to talk about a common objective. With this in mind it is recommended that another Forum be planned for within the next 24 months (likely spring 2006). Using feedback from participants combined with the opinions of current stakeholders, a decision will be made on when and where the next Forum will occur, and generally what range of topics should be addressed.
- b) Formation of an Energy R&D Network – shortly after the Forum ended, the Nova Scotia Department of Energy (NSDE) recommended the creation of a partnership network of individuals from government, industry and academia that are closely tied to energy research and development. NSDE presented the group with a draft outline of what it felt should be the Network’s role. As stated in a draft document, its purpose would be “to link all those across Nova Scotia who are actively supporting, or directly involved in research related to:
 - i. the process of exploring and developing hydrocarbon energy sources;
 - ii. the production and transformation of energy
 - iii. managing the environmental, economic and social impacts from energy development and use (including climate change); and
 - iv. the development of renewable and alternate energy sources as well as technologies to reduce energy consumption or make its use for efficient.”

Members of the proposed Network met during the summer of 2004 to consider province’s recommendation, discussed its value and roles, and generally concluded that the Network would be of value to everyone. Further action in this area has not yet been taken, however it is recommended that consideration be given to formally implementing the Network and establishing it as an integral part of the province’s energy R&D agenda.

- c) Workshops/symposia – it has been recommended during post-Forum discussions that smaller-scale workshops and symposia be organized for the purpose of focusing on specific areas of interest to the energy R&D community. Such events could feed into the next larger Forum by bringing information on what is learned about key issues to a broader audience where the focus could then be not so much on learning about specific issues and challenges, but rather on how to incorporate those issues into the province’s energy strategy.

8. Conclusions

The Nova Scotia Energy Research and Development Forum was considered by sponsors, organizers and participants to be an overall success. The unique atmosphere and program attracted 227 registrants with 212 participating (see Appendix D for list of registrants), including 58 speakers and moderators, and 39 students. Participants included diverse and numerically equal representation by industry, academia and government which resulted in significant opportunity for interaction and discussion on issues that transcend individual disciplines within the energy sector.

The Forum provided for an opportunity to see examples of some of the key research and development initiatives that are currently taking place in Nova Scotia, and to a lesser extent what industry would like to see coming out of the research community. It is apparent that even with a relatively small number of researchers in Nova Scotia, a broad range of interests are represented in the various institutions, covering such topics as oil and gas exploration and production, alternative energy sources, environmental impact assessment, energy efficiency, risk assessment, modeling and much more. The Forum highlighted a few areas where there appears to be concentrated expertise including geosciences and environmental sciences.

The Forum also emphasized the fact that although the driver behind some research is basic curiosity, innovation and implementation are essential in order to compete on a global scale, oftentimes to solve global problems. This is being addressed in part by inter- and intra-institutional collaboration, however more needs to be done to encourage commercialization of research. Challenges, whether they are barriers imposed by disincentives on the part of researchers (ex. preference is to publish rather than commercialize), funding shortages, lack of receptor capacity, or other factors, should be seen as opportunities for growth, but this requires a strategic approach on the part of all parties to make it happen.

The success of this Forum has prompted interest in making it a regular event. Discussions are being held to incorporate the expressed interests of participants regarding when and where the next Forum should be held, and more particularly what the theme and content should be. It is anticipated that the next Forum will be held in the spring of 2006.

APPENDIX A

List of Sponsors (alphabetical)

Generous sponsorship was provided by the following organizations for the 2004 Forum. Monies were specified for various causes including general planning, student registration and accommodations, conference rooms and a social reception.

BP Canada Energy Company	\$400
Canadian Association of Petroleum Producers	\$200
Chevron Canada Resources	\$500
Cox Hanson O'Reilly Matheson	\$500
Emera Inc.	\$1,000
EnCana Corporation	\$1,000
Hydrosearch	\$200
Nova Scotia Department of Energy	\$5,000
Offshore/Onshore Technologies Association of Nova Scotia	\$200
Petroleum Research Atlantic Canada	In-kind (staff resources)
Shell Canada	\$500
St. Francis Xavier University	In-kind (facilities)
Transocean	\$200

APPENDIX B

Energy Forum 2004 Program

Nova Scotia Energy Research & Development Forum 2004 - Program

DAY 1 - Thursday May 13, 2004

8:00 - 8:40	Registration and Coffee		
8:40 - 8:55	Welcome and Opening Remarks - Mr. Dan McFadyen, Deputy Minister, Nova Scotia Department of Energy		
8:55 - 9:40	Plenary 1: R&D Needs for the Atlantic Energy Sector, and What We Do About Them - Mr. Chris Huskilson, COO, Emera Inc.		
9:40 - 12:00	Panel - Energy Research: A Concentrated Approach		
9:40 - 9:45	Moderator: Dr. Ross McCurdy, <i>InnovaCorp</i>		
9:45 - 10:05	- Centre for Applied Petroleum Sciences - Dr. David Pink, <i>St. Francis Xavier University</i>		
10:05 - 10:25	- Energy @ Dal - Dr. Grant Wach, <i>Dalhousie University</i>		
10:25 - 10:40	Coffee Break		
10:40 - 11:00	- Saint Mary's University - Dr. Andrew MacRae		
11:00 - 11:20	- Centre for Estuarine Research - Dr. Graham Daborn, <i>Acadia University</i>		
11:20 - 11:40	- Centre of Excellence in Petroleum Development - Ms. Lucia MacIsaac, <i>University College of Cape Breton</i>		
11:40 - 12:00	- Petroleum Research Atlantic Canada/Energy R&D Database - Lee Shinkle/Rod Doane, <i>PRAC</i>		
12:00 - 13:00	Lunch		
13:00 - 15:10	Workshop 1		
	Oil & Gas - Deepwater Nova Scotia	Using Energy Wisely - Supply Choices	Energy & the Ocean Environment
13:00 - 13:05	Moderator: Grant Wach, <i>Dalhousie University</i>	Moderator: William Richards, <i>Nova Scotia Power Inc.</i>	Moderator: Ken Lee, <i>Fisheries and Oceans Canada</i>
13:05 - 13:30	- Deepwater Nova Scotia: Challenges - Mr. John Hogg, <i>EnCana Corporation</i>	- Overview of Supply Choices - Mr. Chris Feetham, <i>Environment Canada</i>	- Environmental Challenges - Mr. Geoff Hurley, <i>Hurley Environment Ltd.</i>
13:30 - 13:55	- Deepwater Petroleum Systems of the Scotian Slope - Dr. Muki Mukhopadhyay, <i>Global Geoenergy Research</i>	- Alternative Fuels - Fuel Cells - Dr. David Stevens, <i>Dalhousie University</i>	- Identification and Conservation of Sensitive Marine Areas - Dr. Martin Willison, <i>Dalhousie University</i>
13:55 - 14:20	- Deepwater Geohazards of the Scotian Slope - Dr. David Mosher, <i>Geological Survey of Canada (Atlantic)</i>	- Clean Coal Technology - Mr. Bob Stobbs, <i>Canadian Clean Power Coalition</i>	- Optimizing Use of Existing Data for Environmental Assessment - Mr. Ted Potter, <i>Fisheries and Oceans Canada</i>
14:20 - 14:45	- Gas Hydrates - Dr. Peter Kusalik, <i>Dalhousie University</i>	- Unconventional Fuels - Dr. Larry Hughes, <i>Dalhousie University</i>	- Drilling Wastes - Risk Assessment - Dr. Kee Muschenheim, <i>Acadia University</i>
14:45 - 15:10	- Salt Tectonic Sub-Provinces Beneath the Scotian Slope - Mr. John Shimeld, <i>Geological Survey of Canada (Atlantic)</i>	- Alternative Fuels - Solar Energy - Dr. Peter Allen, <i>Dalhousie University</i>	- Environmental Effects Monitoring - Mr. Peter Wells, <i>Environment Canada</i>
15:10 - 15:30	Coffee		

DAY 1 Continued

15:30 - 17:40	Workshop 2		
	Oil & Gas - Linking Data with Knowledge	Using Energy Wisely - Demand Side Management	Energy & the Ocean Environment
15:30 - 15:35	Moderator: Grant Wach, <i>Dalhousie University</i>	Moderator: Robert Eagle, <i>Dalhousie University</i>	Moderator: Eric Theriault, <i>CNSOPB</i>
15:35 - 16:00	- Data Acquisition Challenges - Mr. Jim Covill, <i>Martec Limited</i>	- Overview of Demand-side Management - Mr. Stephen Dixon, <i>TdS Dixon Inc.</i>	- Environmental Impacts - Ms. Sue Belford, <i>Jacques Whitford</i>
16:00 - 16:25	- Data Transmission Challenges - Mr. John Moloney, <i>MacDonald Dettwiler</i>	- Load Shaping - Mr. Bill Stewart, <i>Bowater</i>	- Produced Water - Dr. Kenneth Lee, <i>Fisheries and Oceans Canada</i>
16:25 - 16:50	- Data Accessibility and Its Implications - Dr. Andrew MacRae, <i>Saint Mary's University</i>	- Energy Efficiency in Institutional Buildings - Mr. Phil Cox, <i>NS Transportation and Publics Works</i>	- Potential Impacts on Fisheries - Dr. Jerry Payne, <i>Fisheries and Oceans Canada</i>
16:50 - 17:15	- Data Mining - Dr. Nick Cercone, <i>Dalhousie University</i>	- Power Supply Management - Mr. Chuck Faulkner, <i>Nova Scotia Power</i>	- Sound Propagation Models for Assessment of Risk from Seismic Surveys - Mr. Scott Carr, <i>JASCO Research</i>
17:15 - 17:40	- Visualization - Dr. Matt Hall, <i>Landmark Graphics</i>	- Roundtable Discussion - Panelists from Sessions 1 and 2	- Seismics - Dr. Jack Lawson, <i>Fisheries and Oceans Canada</i>
17:40	Reception and Networking		

DAY 2 - Friday May 14, 2004

8:45 - 9:15	Opening Remarks - Ms. Debbie Windsor, <i>Director General, Business Development, ACOA</i>		
9:15 - 10:00	Plenary 2 - Plenary Address: Mr. Graham Campbell, <i>Director General, Office of Energy R&D, Natural Resources Canada</i>		
10:00 - 10:30	Coffee		
10:30 - 12:15	Workshop 3		
	Oil & Gas - Risk	Using Energy Wisely - Climate Change	Energy & the Ocean Environment
10:30 - 10:35	Moderator: Steve Foran, <i>NSCC</i>	Moderator: Robert Eagle, <i>Dalhousie University</i>	Moderator: Debora Walsh, <i>CAPP</i>
10:35 - 11:00	- Risk and Uncertainty: Key Inputs to Project Planning and Portfolio Management - Dr. Graeme Simpson, <i>Gaffney Cline & Assoc.</i>	- The Science of Climate Change - Dr. Glen Lesins, <i>Dalhousie University</i>	Technology Application Development and Applications to Address Environmental Challenges - Mr. Stephen Whidden, <i>WesternGeco</i>
11:00 - 11:25	- Risk Management: Perception Versus Reality - Dr. Mark Fleming, <i>Saint Mary's University</i>	- Mitigation Through Reduction of Emissions - Dr. Des Cousens, <i>Nova Scotia Power Inc.</i>	- Application of Geomatics to Environmental Issues - Dr. Bob Maher, <i>Nova Scotia Community College</i>
11:25 - 11:50	- Project Risk and Multiple Regulatory Authorities - Dr. Jerome Davis, <i>Dalhousie University</i>	- ClimAdapt: Nova Scotia's Climate Change Adaptation Initiative - Mr. Alan Bell, <i>Environmental Management Services</i>	- Biofilms - Dr. David Pink, <i>St. Francis Xavier University</i>
11:50 - 12:15	- Managing Energy Price Risk - Dr. Richard Nason, <i>Dalhousie University</i>	- Implications of Climate Change in the Energy Sector - Mr. Kyle McKenzie, <i>Dalhousie University</i>	- Wind and Wave Forecast Models - Dr. Will Perrie, <i>Fisheries and Oceans Canada</i>
12:15 - 13:15	Lunch		
13:15 - 15:00	<u>Linking Research to Applications: Opportunities and Challenges</u>		
13:15 - 13:20	Moderator: Lee Shinkle, <i>Executive Director, Petroleum Research Atlantic Canada</i>		
13:20 - 13:45	- Innovation and Commercialization. What Does It Really Mean? - Dr. Jim McNiven, <i>Faculty of Management, Dalhousie University</i>		
13:45 - 14:10	- Role of the University in Commercialization and Intellectual Property - Dr. Carl Breckenridge, <i>VP Research, Dalhousie University</i>		
14:10 - 14:35	- Role of Government in Commercializing Research - Mr. Alan Miller, <i>ACOA</i>		
14:35 - 15:00	- Linking Researchers with the Business Community - Dr. Ross McCurdy, <i>CEO, InnovaCorp</i>		
15:00 - 15:30	Conference Wrap-up - Dr. Sean Riley, <i>President, St. Francis Xavier University</i>		
15:30	Meeting rooms available for post-conference meetings		

APPENDIX C

Forum Evaluation Feedback

Evaluation Statement Responses

1: The panel sessions (Energy Research: A Concentrated Approach, and Linking Research to Applications) presented information that was important and interesting.

	Percent
Disagree	4.3
Neutral	10.6
Agree	72.3
Strongly Agree	12.8

2A: In Workshop 1 I attended the session on:

	Percent
Oil and Gas – Deepwater	42.9
Using Energy Wisely – Supply Choices	32.7
Energy and the Ocean Environment	18.4
Combination of Sessions	6.1

2B: The first workshop provided useful information that helped me better understand some of the current research and its significance to Nova Scotia.

	Percent
Disagree	3.8
Neutral	3.8
Agree	65.4
Strongly Agree	26.9

2C: The first workshop provided adequate opportunity for discussion about relevant issues.

	Percent
Disagree	11.8
Neutral	17.6
Agree	60.8
Strongly Agree	9.8

3A: In Workshop 2 I attended the session on:

	Percent
Oil and Gas – Linking Data with Knowledge	18.8
Using Energy Wisely – Demand-side Mgmt.	35.4
Energy and the Ocean Environment	39.6
Combination of Sessions	6.3

3B: The second workshop provided useful information that helped me better understand some of the current research and its significance to Nova Scotia.

	Percent
Disagree	4.3
Neutral	6.5
Agree	63.0
Strongly Agree	26.1

3C: The second workshop provided adequate opportunity for discussion about relevant issues.

	Percent
Disagree	8.3
Neutral	18.8
Agree	64.6
Strongly Agree	8.3

4A: In Workshop 3 I attended the session on:

	Percent
Oil and Gas – Risk	19.1
Using Energy Wisely – Climate Change	36.2
Energy and the Ocean Environment	29.8
Combination of Sessions	14.9

4B: The third workshop provided useful information that helped me better understand some of the current research and its significance to Nova Scotia.

	Percent
Strongly Disagree	2.2
Disagree	4.3
Neutral	8.7
Agree	73.9
Strongly Agree	10.9

4C: The third workshop provided adequate opportunity for discussion about relevant issues.

	Percent
Disagree	4.3
Neutral	21.7
Agree	65.2
Strongly Agree	8.7

5: The Forum will help to define some of the energy research priorities facing Nova Scotia.

	Percent
Disagree	3.8
Neutral	19.2
Agree	63.5
Strongly Agree	13.5

6: I believe we have identified some of the gaps in current energy research.

	Percent
Disagree	7.5
Neutral	26.4
Agree	56.6
Strongly Agree	9.4

7: Participants in this event represented a good balance from all sectors with a stake in the province's energy future.

	Percent
Strongly Disagree	1.9
Disagree	7.5
Neutral	17.0
Agree	47.2
Strongly Agree	26.4

8: I will be able to use some of the information I gained to influence my future involvement in energy research activities.

	Percent
Neutral	5.8
Agree	73.1
Strongly Agree	21.2

9: The program was well designed.

	Percent
Disagree	3.8
Neutral	3.8
Agree	59.6
Strongly Agree	32.7

10: Prior to the Forum I received an appropriate amount of information and communication.

	Percent
Disagree	7.7
Neutral	21.2
Agree	50.0
Strongly Agree	21.2

11: I enjoyed the reception and think it was a valuable part of the format.

	Percent
Strongly Disagree	2.1
Disagree	2.1
Neutral	14.6
Agree	47.9
Strongly Agree	33.3

12: The conference and accommodation facilities were up to my standards.

	Percent
Neutral	7.8
Agree	35.3
Strongly Agree	56.9

13: In general, the Forum increased my knowledge of Nova Scotia energy research and development.

	Percent
Agree	51.9
Strongly Agree	48.1

14: I am interested in attending future Forums similar to this one.

	Percent
Agree	60.8
Strongly Agree	39.2

15: I am from the following sector:

	Percent
University	12.5
Graduate Student	27.1
Exp. and Prod.	4.2
Supply and Service	12.5
Consulting	14.6
Other industry	6.3
Government	18.8
Non-government org.	2.1
Other government	2.1

Additional Comments

1. The most effective Forum features were:

- Networking
- Presentations
- Parallel technical tracks
- The opening panels outlining the various research capabilities and desired niches
- Food
- Open discussion with people in industry at poster sessions and reception
- Variety of professionals
- Opportunity for input and questions
- Commercialization panel on final day
- Quality and depth of information covered
- Location and atmosphere
- Organization
- Deepwater session
- Opening address by Chris Huskilson
- Good pace
- Low cost
- Demand-side Management session
- Kept on schedule

Numerous people commented on the networking opportunity presented by the Forum.

2. The least effective Forum features were:

- Rooms were a little too small
- Plenaries and posters
- Overly technically complicated research descriptions and the few overtly “commercial” presentations
- Hard to focus on a specific component – wanted to cross over more to other rooms
- Long presentations
- Networking
- Panels
- Duplication of some topics such as climate change
- Not enough time for presentations – need time to talk
- Campbell presentation was purely bureaucratic
- Presentations were a means for presenters to pontificate
- Presentations focused too much on programs and not enough on ideas
- Except for DSM workshop the entire demand side of energy equation was omitted. The potential for research on conservation should have been stressed
- Presenters reading slides to a largely literate audience
- Tendency toward information overload
- Not enough time for discussion
- Information was often too vague
- Friday morning session
- Climate change
- Some IT problems that could have been avoided if presenters had forwarded material in advance

3. I would like to offer the following suggestions:

- Have fewer plenaries
- More opportunity for discussion
- Longer breaks to view posters
- Keep government grandstanding to a minimum
- Keep up good work
- Day 1 a bit too long
- Very well done
- More flexibility for jumping from one session to another
- Provide water at tables
- Excellent, high caliber
- Advertising was unfocused
- Make presentations shorter to allow for more discussion
- 1.5 day likely enough
- Specify time for breakfast in program

- Specify location of reception in program
- Plenary addresses not challenging enough
- Workshop sessions over detailed
- Overall well done
- Coffee to start second day
- Require industry presenters to show areas that require further R&D – would be good for researchers to see where the opportunities are
- Panel session wasn't a panel
- Forum should be an annual event used to build on research database mentioned by Rod
- Less talk by panel members and more time for discussion
- Can't suggest anything "I think you guys did a great job!!"
- By listening through the panel sessions I learned there is not nearly enough R&D in electricity usage
- A forum/discussion of cradle to grave economics would have been beneficial
- Need more time for questions – have people write them down and have the moderator read them
- Would have been nice to attend a variety of the workshops – the environmental workshop was so good you didn't want to miss one to attend another
- Provide a mouse with PC's for presenters
- Too many papers in the workshops (have 4 each instead of 5)
- Plenary addresses were very informative
- Qualifications of members was most impressive

4. If I were managing the Forum I would:

- Pat myself on the back, good job!
- Try to build on this success
- Increase spacing between poster stands
- Load everyone's material earlier and on time
- Be more clear on objectives and desired outcome
- 1.5 days likely enough
- Include poster presentations in the Forum, combine reception with poster discussion
- Keep the food and accommodation style
- Plan another one two years from now with more representation from industry
- Lunches need to be in special rooms so people can network
- Set out a limited number of clearly defined statements to be dealt with in the various sessions with session chairs reporting back in a final session, so that it results in a well-defined agenda for the future/recommendations for government, industry and academia
- Have a workshop focusing on the electricity sector, another focusing on research to conserve energy and another to focus on the demand side of the energy equation
- Reschedule in two years or 18 months

- Work to get more consultants to attend
- Replace last section with a summary and recommendations session
- Involve industry sectors as much as possible

5. Other comments:

- Some presentations were a bit dry
- Good Forum, impressive
- Great venue, local hospitality – a fun two days
- Very well structured and many interests represented
- Keep all functions in one building whenever possible
- What was the goal? To raise awareness of issues and capabilities – successful; to enhance interaction – successful for gov. and academics but weak on industry; to provide direction on NS Energy Policy/Strategy – a failure I think
- Well done
- Do it again – major speakers should show up – make presentations available on a timely basis
- Extend the \$ for student sponsorship. I thank the organizers for sponsoring students, it's a great idea
- On-campus apartments were very nice
- Summer is not a good time to hold this and you want to stay away from other energy conferences – consider holding every two years
- This was a very good get-together in that there was such a high diversity of professionals
- Keep the coffee hot – it was cool by the end of the coffee break
- Low cost is good – not a barrier to participation – Email or CD of presentations would be good
- Too few presentations on R&D, innovation for land-based natural gas and electricity users. The Forum may have been heavily weighted toward off-shore production
- Many presentations were simply overviews and there was limited discussion about moving forward in research on particular topics
- Would have been nice to have dinner
- Session 3 – one of the speakers wasn't about ocean environment
- Would like to see a wrap that provides real guidance on the gaps and needs
- Presentations printed with several slides per page with space for notes would have been useful

APPENDIX D

List of Registrants

Name	Title	Affiliation
N. Ben Abdallah	Professor	Dalhousie University
Juergen Adam	Research Associate	Dalhousie University
Lukman Ajijolaiya	Student	Dalhousie University
Adel Al Taweel	Professor	Dalhousie University
Peter Allen	Professor	Dalhousie University
Rosalie Allen-Jarvis	Program Coordinator/COOGER	Fisheries and Oceans Canada
Pradeep Appasani	Student	Dalhousie University
Victoria Arbour	Student	Dalhousie University
Joe Armishaw	Senior Development Officer	Enterprise Cape Breton Corporation
Brent Austin	Business Development Advisor	EnCana Corporation
Graham Bagnell	Engineering Manager	Rowan Companies, Inc.
Mark Barry	Student	Dalhousie University
Prabir Basu	Director, Circ. Of Fluidized Bed Lab.	Dalhousie University
Tina Battcock	Senior Project Advisor	El Paso Canada Pipeline Company
Susan Belford	Senior Marine Biologist	Jacques Whitford
Alan Bell		Alan Bell Environmental Management Services
Jeff Bell	Student	Dalhousie University
Hugo Beltrami	Associate Professor	St. Francis Xavier University
John Blackwell	Director, Research Grants	St. Francis Xavier University
Kim Blanchette	Director of Communications	Nova Scotia Department of Energy
Mathew Bligh	Student	Dalhousie University
Carl Breckenridge	VP Research	Dalhousie University
Laura Bristow	Communications Assistant	Nova Scotia Department of Energy
Brendan Brothers		Newpark Canada Inc.
Keith Brown	Dean and Managing Director	University College of Cape Breton
Tim Brownlow	Chairman	Offshore/Onshore Technologies Assoc. of Nova Scotia
Ray Burke	Research and Dev. Manager	Canadian Seaboard Research Ltd.
William Caley	Professor/Dean	Dalhousie University
Bruce Cameron	Director, Policy & Analysis	Nova Scotia Department of Energy
Graham Campbell	Director General	Natural Resources Canada
Scott Carr	Vice President East. Operations	JASCO Research Ltd.
Nick Cercone	Dean	Dalhousie University
Theodore Chaisson	Assistant Professor	Dalhousie University
David Chaundy	Economist	Atlantic Provinces Economic Council
Ronald Chisolm		Antigonish Regional Development Authority
Peter Clancy	Professor	St. Francis Xavier University
Lauren Clarke	Student	Queen's University
Scott Coffen-Smout	OCMD	Fisheries and Oceans Canada
Bob Colbourne	Maint. Mgmt. Specialist	Public Works and Government Services Canada
Jim Connors	Vice President Reg. Affairs	Emera Inc.
Joseph Connors	Communications Coordinator	Petroleum Research Atlantic Canada
Lori Cook	MSc Student	Acadia University
William Cormier	Assistant Professor	St. Francis Xavier University
Des Cousens	Senior Specialist Environment	Nova Scotia Power Inc.
Jim Covill	Computer Scientist	Martec Limited
Phillip Cox	Senior Design Engineer	Nova Scotia Transportation and Public Works
Graham Daborn	Director	Acadia Centre for Estuarine Research

Jerome Davis	Professor	Dalhousie University
Edwin Demont	Professor	St. Francis Xavier University
John Dickie	Manager, Training and Promotion	Nova Scotia Department of Energy
Jennifer Dixon	Organic Contamination Analyst	Fisheries and Oceans Canada
Stephen Dixon	President	TdS Dixon Inc.
Rod Doane	Dir. Inf. Systems and Knowledge Mgmt.	Petroleum Research Atlantic Canada
Adam Donald	Student	Dalhousie University
Howard Donahoe	Planning & Development Officer	Nova Scotia Department of Natural Resources
Douglas Duggan	Advisor	Natural Resources Canada
Animesh Dutta	Research Manager	Greenfield Research Incorporated
Robert Eagle	Dir. Sexton Campus Research Office	Dalhousie University
Nick Easton		Neill & Gunter (NS) Ltd.
Chuck Faulkner	Senior Technical Advisor	Nova Scotia Power Inc.
Skya Fawcett	Student	St. Francis Xavier University
Chris Feetham	Climate Change Outreach Specialist	Environment Canada
Mark Fleming	Assistant Professor	Saint Mary's University
George Foot		
Dale Foote	Meteorologist	Environment Canada
Steve Foran	Director Energy Group	Nova Scotia Community College
Robert Fournier	Professor	Dalhousie University
Paul Frempong	Student	Dalhousie University
Alan Fung	Professor	CREEDAC - Dalhousie University
Raymond Gallant	Director General Programs	Atlantic Canada Opportunities Agency (Moncton)
Limin Gao	Student	Dalhousie University
Jeff Garnhum	Advisor to Deputy Minister	Nova Scotia Department of Energy
Glen Gibling	Industry Outreach Manager	Petroleum Research Atlantic Canada
Lara Gibson		Nova Scotia Department of Energy
Chris Giddens	Development Officer	Atlantic Canada Opportunities Agency (Halifax)
Colleen Gillis	Administrative Assistant	St. Francis Xavier University
Sean Gillis		Newpark Canada Inc.
Ed Glover	Student	Centre of Geographic Sciences
Joel Good	Student	Dalhousie University
Bob Green	Policy Analyst	Nova Scotia Department of Energy
Matt Hall	Business Development Manager	Landmark Graphics
Lars Hallstrom	Assistant Professor	St. Francis Xavier University
Paul Harvey	Senior Petroleum Geophysicist	Nova Scotia Department of Energy
Bilal Hassan	Student	Dalhousie University
Andrew Henry	Administrator	Dalhousie University
John Hogg	VP, Atlantic Canada	EnCana Corporation
Doug Hollett	Area Manager	Marathon Canada Petroleum ULC
Larry Hughes		Dalhousie University
Eric Hundert	Nova Scotia District Manager	Environment Canada
Geoffrey Hurley	President	Hurley Environment Ltd.
Chris Huskilson	COO	Emera Inc.
Michael Jenkins	Engineering Manager	Nova Dynamics Limited Consulting Engineer
Samantha Jones	Student	Dalhousie University
William Jones	Acting Dean FGSR	Saint Mary's University
Alain Joseph	PhD Student	Dalhousie University
Elliott Keizer	Director, Government Services	University of New Brunswick
Lisa Kellman	Associate Professor	St. Francis Xavier University

Karen Kelloway	Senior Communications Advisor	Nova Scotia Department of Energy
Andrew Kendall	Industry Liaison Officer	St. Francis Xavier University
Kris Kendall	Petroleum Geophysicist	Nova Scotia Department of Energy
Bob Kerr	SHE/OIMS Reg. Manager	ExxonMobil
Yawooz Kettanah	Visiting scholar	Dalhousie University
Karen King	Graduate Student	St. Francis Xavier University
Thomas King	Chemist	Fisheries and Oceans Canada
Brian King	Senior Consultant	Neill & Gunter (NS) Ltd.
Elisabeth Kusters	Self-employed	
Peter Kusalik	Professor	Dalhousie University
Jack Lawson	Research Scientist	Fisheries and Oceans Canada
Geoff Lebens	Co-owner	Brooke Ocean Technology Ltd.
Larry Leblanc	CEO	Renewable Energy Services Limited
Ken Lee	Executive Director COOGER	Fisheries and Oceans Canada
Glen Lesins	Research Assoc.	Dalhousie University
Geoff Lewis		Industry Canada
Judith Lipp	PhD Student	Dalhousie University
Luciano Lisi	CFO	Cape Breton Power Ltd.
Stephen Locke	Manager Sustainable Dev. Initiatives	Public Works Canada
Ian MacCallum		
Jack MacDonald	Senior Petroleum Geologist	Nova Scotia Department of Energy
Ronnie MacDonald	Oil & Gas Comm. Antigonish RDA	Antigonish Regional Development Authority
Greg MacDonald	Regulatory and Env. Sup.	ExxonMobil
Adam MacDonald	Student	Saint Mary's University
Colin MacDonald	East Coast Manager	Newpark Canada Inc.
Lucia MacIsaac	Director CEPD	University College of Cape Breton
Jane MacKenzie	Secretary	Nova Scotia Department of Energy
Leon MacLean	Director of Facilities Mgmt.	St. Francis Xavier University
Andrew MacRae	Assistant Professor	Saint Mary's University
Vandirai Madenga	Student	Dalhousie University
Srinath Madhavan	Research Engineer	Dalhousie University
Bob Mahar	Senior Research Scientist	Nova Scotia Community College Annapolis Valley
Charles Martin	Policy Analyst	Atlantic Canada Opportunities Agency (Halifax)
Roland Martin	Chairman	Martillac Limited
Hosein Marzi	Assistant Professor	St. Francis Xavier University
Jennifer Matthews	R&D Manager	Petroleum Research Atlantic Canada
Michael Mattie	Project Engineer	Nova Construction Company Ltd.
Ross McCurdy	CEO	InNovacorp
Paul McEachern	Managing Director	Atlantic Canada Opportunities Agency (Halifax)
Dan McFadyen	Deputy Minister	Nova Scotia Department of Energy
Kyle McKenzie		Dalhousie University
James McNiven	RA Jodrey Professor of Commerce	Dalhousie University
Karen McNulty	Technical Research	Guysborough County Regional Development Authority
James Meade	Senior Regional Habitat Biologist	Fisheries and Oceans Canada
Matthew Middleton	Student	St. Francis Xavier University
Phil Moir	Geologist	Geological Survey of Canada (Atlantic)
John Moloney	Solution Engineer	MacDonald Dettwiler & Associates
David Mosher	Research Scientist	Geological Survey of Canada (Atlantic)
P.K. Mukhopadhyay	Adjunct Professor	Dalhousie University
Howlan Mullally	Energy Coordinator	Ecology Action Centre

Margaret Murphy	Manager Public Affairs	Nova Scotia Power Inc.
Kee Muschenheim	Research Associate	Acadia Centre for Estuarine Research
Rick Nason	Assistant Professor	Dalhousie University
Jaspreet Singh Nijjar	Student	Dalhousie University
Jeff O'Keefe	Petroleum Engineer	Gov. of Newfoundland and Labrador DNR
Hycienth Onovwiona	Student	Dalhousie University
Suryakiran Pallapothu	Student	Dalhousie University
Peter Panagapko	President	Manomet International Inc.
Allan Parker	Manager Climate Change Division	Nova Scotia Department of Energy
Andrew Patton	Student	Nova Scotia Agricultural College
Jerry Payne	Research Scientist	Fisheries and Oceans Canada
Jim Peers	President	Peers Management Associates
Will Perrie	Research Scientist	Fisheries and Oceans Canada
John Phyne	Professor	St. Francis Xavier University
Barbara Pike	Public Information Coordinator	Canada Nova Scotia Offshore Petroleum Board
David Pink	Research Professor	St. Francis Xavier University
Krishna Podila	Research Engineer	Dalhousie University
Peter Poole	Associate Professor	St. Francis Xavier University
Ted Potter	Section Head Habitat Mgmt.	Fisheries and Oceans Canada
Mark Raymond	Professor	Saint Mary's University
Bale V. Reddy	Associate Professor	University of New Brunswick
Donald Regan	Superintendent	Berwick Electric Company
Aurora Reid	Policy Analyst	Canadian Association of Petroleum Producers
Bill Richards	Engineering Specialist	Nova Scotia Power Inc.
Sean Riley	President	St. Francis Xavier University
Ray Ritcey	President	Heritage Gas Limited
Jayne Roma		Environment Canada
Melody Rooyackers		Maple Melody Mountain Maple Inc.
Tony Rose	Department Head	Nova Scotia Community College
Carey Ryan		Petroleum Research Atlantic Canada
Billy Shaw		W.G. Shaw and Associates Ltd.
Marc Sheeran	GHG Reduction Specialist	Environment Canada
John Shimeld	Geophysicist	Geological Survey of Canada (Atlantic)
Lee Shinkle	Executive Director	Petroleum Research Atlantic Canada
Graeme Simpson		Gaffney Cline & Associates
Kent Simpson	Student	Dalhousie University
Jeff Slipp	Manager ITIC Engineering Labs	University College of Cape Breton
George Smith	Dir. of Technical Analysis	Nova Scotia Utility and Review Board
Somasuntharam	Student	Dalhousie University
Somaarunachalam		Natural Resources Canada
Gary Sonnichsen	Marine Geologist	SpryTech Biological Services
Jacquelyn Spry		St. Francis Xavier University
Ryan Stanley	Student	Dalhousie University
David Stevens	Post-Doc	Bowater Mersey Paper Company Ltd.
Bill Stewart	Manufacturing Services Mgr.	David C. Stewart & Associates Inc.
David Stewart	President	Canadian Clean Power Coalition
Bob Stobbs	Executive Director	Nova Scotia Department of Energy
Bobby Sutherland	Senior Policy Advisor	Environment Canada
Steve Szabo	Manager, Climate Change Division	ChevronTexaco
Drew Taylor	Manager, Nova Scotia Operations	Canada Nova Scotia Offshore Petroleum Board
Eric Theriault	Advisor Environmental Affairs	

Ian Thompson	VP External Relations	Emera Inc.
Mark Townsend	Economic Development Officer	South West Shore Development Authority
Mike Tripp		Acadia University
Andrew Trivett	Associate Professor	University of Prince Edward Island
Scott Trollope	Exp. Advisor and Chief Geologist	Shell Canada Ltd.
Matt Vance	Student	Dalhousie University
Ramanathan Venkataraman	Student	Dalhousie University
Anthony Vriends		University of Prince Edward Island
Grant Wach	Professor	Dalhousie University
Tom Wadden	Comptroller	Town of Antigonish
Peter Wade		Neill & Gunter (NS) Ltd.
John Walker	Manager, Air Quality	Jacques Whitford
Debora Walsh	Manager, Atlantic Canada	Canadian Association of Petroleum Producers
Anne Warburton	Student	Dalhousie University
Brian Watling	Vice President Development	Wind Driven Inc.
Peter Wells	Senior Research Scientist	Environment Canada
Stephen Whidden	Canada Manager	WesterGeco
Mark Williamson	Program Manager	Natural Resources Canada
Martin Willison	Professor	Dalhousie University
Tom Windeyer		Neill & Gunter (NS) Ltd.
Debbie Windsor	Acting Director General, Business Development	Atlantic Canada Opportunities Agency
Miles Winters	Business Segment Mgr	Halliburton Group Canada
John Woods	Executive Director	Electricity Consumers Alliance of Nova Scotia
Chaoqiang Xu	Student	Dalhousie University
Rob Young	Practice Leader	Dillon Consulting Limited
Phil Zamora	Habitat Assessment Biologist	Fisheries and Oceans Canada
John Zevenhuizen	Project Manager	Orca Marine Geological Consultants Ltd.
Changsuo Zhang	Student	Dalhousie University
Pifu Zhang	Student	Dalhousie University
Steve Zou	Professor	Dalhousie University