

Building Paths to a Low Carbon Society



Ivey

Richard Ivey School of Business
The University of Western Ontario

DEVELOPING SUSTAINABLE ENERGY POLICY WORKSHOP

October 22-24, 2006

LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT



Building Paths to a Low Carbon Society



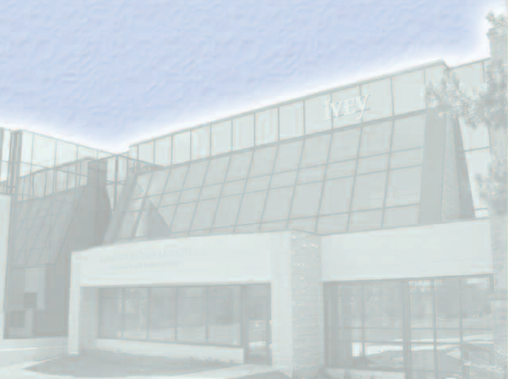
IVEY

Richard Ivey School of Business
The University of Western Ontario

DEVELOPING SUSTAINABLE ENERGY POLICY WORKSHOP

October 22-24, 2006

LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT



Ivey

Mission

THE LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

The Lawrence National Centre is committed to the development of sound public policy by providing a national forum for business, academia, and government to think globally, act strategically, and contribute to the societies in which they operate. The Centre creates dynamic networks that bridge business, academia, and government.

“If we could really achieve more cooperation between government and business, we would see a quantum leap in economic performance and productivity.”

Jack Lawrence FOUNDER, THE LAWRENCE NATIONAL CENTRE FOR POLICY AND MANAGEMENT

DEVELOPING SUSTAINABLE ENERGY POLICY WORKSHOP

Building Paths to a Low Carbon Society Series

The “*Developing Sustainable Energy Policy Workshop*”, part of the Building Paths to a Low Carbon Society series, was held at the Lawrence National Centre for Policy and Management at the Richard Ivey School of Business, the University of Western Ontario on October 22-24, 2006. The workshop was the second in a series, following the September, 2005 meeting at the Centre for Global Studies, the University of Victoria in British Columbia.

The Social Sciences and Humanities Research Council of Canada (SSHRC), Natural Resources Canada (NRCan), Ontario Ministry of Energy, and the Ontario Centres of Excellence-Centre for Energy were our major financial contributors, who encouraged collaboration and provided ongoing advice. Our other sponsors were The City of London, London Hydro, Bell Canada Enterprise, Capgemini and Honeywell Limited. We are grateful for their ongoing support and encouragement.

A background document entitled, “*An Overview of Renewable Energy in Ontario*” was written by Bas C. Van Berkel and Ryan Little of StormFisher Inc., to provide an overview of the renewable energy landscape in Ontario. Participant Perspective Statements were requested in advance and subsequent to the workshop. These materials, among others, are posted on the Lawrence National Centre website.

The workshop also included a special session for students, “*How Major Decisions Get Made: The Cabinet Process*” presented by Kevin Chan, Executive Assistant to the Deputy Secretary to the Cabinet (Operations), Privy Council Office in Ottawa to provide insight as to how decisions that affect the entire economy were made and how policy is developed at the highest levels. The students at Ivey had the opportunity to listen to Mr. Chan speak on these issues, as well as have their questions answered regarding how they can pursue exciting employment opportunities in strategic policy for the Government of Canada.



Ivey

Director's Message



I would like to extend my thanks and congratulations to everyone who contributed to the Lawrence Centre's Developing Sustainable Energy Policy Workshop. The workshop brought together many of the best and brightest minds on sustainable development, energy and global warming in Canada - an extraordinary assembly of over 140 business executives, scientists, academics, government policymakers, consultants, energy experts, students and non-governmental organization leaders.

It was inspiring to witness first-hand the commitment of these people to building a greener and more successful Canadian economy. I am grateful to them for sharing so much of their valuable time and expertise to help achieve that goal. Their contributions will benefit all Canadians by assisting the Government of Canada, the Government of Ontario and municipalities to develop informed public policy that meets the challenges of this country's fast-changing energy, environmental, climate, economic and social realities. This report outlines their key recommendations and provides a summary of their discussions at the workshop.

In planning the workshop, the Lawrence Centre endeavoured to create a neutral forum where a wide range of experts could share their knowledge and perspective on the policy options and challenges facing Canada. To ensure that this initiative would lead to relevant and practical recommendations, the Steering Committee undertook extensive consultations to identify the most pressing issues and then carefully developed the workshop's discussion topics.

Some of the quotes in this report will provide a sense of the participants' passion, energy and wisdom as they presented ideas, options and recommendations. They share an optimism that solutions are achievable and a belief that there is a role for all Canadians to be educated on the issues, to build consensus, and to drive action now in reducing greenhouse gas emissions.

A common thread that surfaced in the discussions is a conviction that Canada's place in the world should be one of strong leadership - that this country should embrace a plan, set the pace, and be at the front of the pack when it comes to building paths to a low carbon society.

We look forward to presenting the workshop's findings, ideas and recommendations to political leaders and government policymakers, and are committed to offering continued support for greenhouse gas reduction efforts. We recognize that this report is one link in a larger chain. It is up to governments to refine and implement policies, to set the pace of action, and to support ongoing research and policy advancement in this area.

The time for cautious, modest steps is over. Now we must embark on a visionary and bold path marked by clear, understandable and measurable milestones. We hope that this report is such a milestone, and that it helps advance government policy in facing the challenge presented by global warming.

Dianne Cunningham



IVEY

John Knuble

Associate Deputy Minister



Congratulations to all the organizers and participants for your successful workshop on Building Paths to a Low Carbon Society, as a contribution to the theme of Developing Sustainable Energy Policy.

It was a great pleasure for me to participate as Associate Deputy Minister of Natural Resources Canada and for the department to be a sponsor.

The workshop was an excellent learning event and well-focused on issues of priority to the Government of Canada - sustainable energy and a low carbon society.

From a Government of Canada perspective, it was excellent to see that the work of the National Roundtable on the Environment and the Economy received so much attention in discussions. This is the primary table for consultations on these issues for the Government of Canada.

Overall, I felt that there was a good cross-section of topics, spanning supply, electricity and end-use. I also found it useful to see consideration of both supply and demand, as well as best practices of the Canadian innovation system and leading-edge technologies. The sessions on Ontario energy supply and end-use were also very helpful to the dialogue since so much of the debate today starts by looking to the west and its challenges.

I want to especially congratulate the Lawrence National Centre at the Ivey Business School, University of Western Ontario and Dianne Cunningham for their enormous contributions to a very successful event.

John Knuble

Associate Deputy Minister
NATURAL RESOURCES CANADA

Richard Ivey School of Business
The University of Western Ontario

IVEY



Building Paths to a Low Carbon Society Workshop

IVEY

Steering Committee Members

Dianne Cunningham *DIRECTOR*
Lawrence National Centre for Policy and Management

Peter C. Johnson *CHAIR*
London Hydro Corporation
Partner, Lerners LLP

Alison Ariss *CONSULTANT, RESEARCH DEVELOPMENT*
Research Western, University of Western Ontario

Guy Holburn *ASSOCIATE PROFESSOR*
Richard Ivey School of Business, University of Western Ontario

Gillian Johnson *WORKSHOP ASSISTANT/STUDENT COORDINATOR*
Lawrence National Centre for Policy and Management

David Moorman *SENIOR POLICY ADVISOR*
Social Science and Humanities Research Council of Canada

Kevin Fitzgibbons *EXECUTIVE DIRECTOR*
Office of the National Science Advisor, Industry Canada

Graham Campbell *DIRECTOR GENERAL, ENERGY POLICY SECTOR*
Office of Energy Research and Development Natural Resources Canada

Vicky Sharpe *PRESIDENT & CEO*
Sustainable Development: Technology Canada

Barry Carin *DIRECTOR, GLOBALIZATION AND GOVERNANCE*
Centre for Global Studies, University of Victoria

Harry Swain *EXECUTIVE DIRECTOR, CANADIAN INSTITUTE FOR CLIMATE STUDIES*
Centre for Global Studies, University of Victoria



IVEY

Table of Contents

- 1** Panelists
- 3** Introduction
- 8** Summary of Recommendations
- 14** **SESSION ONE**
Innovation Failures and the Financial Instruments
Required for Market Success
- 23** **SESSION TWO**
No Single Solution:
Determining Ontario's Optimal Energy Supply Mix for the Future
- 34** **SESSION THREE**
Hydrogen, Hybrids and Husks: Fuels for the Future
- 41** **SESSION FOUR**
Creating a Culture of Conservation: Managing Energy Demand
- 51** **EVERGREEN PAPER PRESENTATIONS**
Climate Constrained Energy Policies: A Modest Proposal
- 57** Participant Perspective Statements
- 59** Workshop Participant List
- 64** Acknowledgements
- 66** Sponsors



IVEY

Panelists

SESSION ONE

Innovation Failures and the Financial Instruments Required for Market Success

CHAIR: **Vicky J. Sharpe** *PRESIDENT & CEO*
Sustainable Development Technology Canada (SDTC)

PANELISTS: **Michael Brown** *EXECUTIVE DIRECTOR & CHAIRMAN OF THE BOARD*
Chrysalix Energy Venture Capital

Todd Tessier *DIRECTOR*
International Capital Markets, Investment Capital Branch,
Ministry of Economic Development, Province of British Columbia

William Tharp *CEO*
Quantum Leap Company Ltd.

Tom Sweeney *MANAGING DIRECTOR & CO-FOUNDER*
Garage Technology Ventures

Andrew Wilkes *CHAIRMAN*
National Angel Organization and Partner, Management Initiatives Inc.

SESSION TWO

No Single Solution: Determining Ontario's Optimal Energy Supply Mix for the Future

CHAIR: **Pamela Nowina** *VICE-CHAIR*
Ontario Energy Board

PANELISTS: **Geoff Ogram** *VICE PRESIDENT*
Asset Management, Hydro One

William (Bill) Smith *VICE PRESIDENT*
Power Generation, Siemens Canada

Glen Murray *CHAIR*
National Round Table on Energy and the Environment

SESSION TWO

Hydrogen, Hybrids and Husks: Fuels for the Future

CHAIR: **Kevin Fitzgibbons** *EXECUTIVE DIRECTOR*
Office of the National Science Advisor, Government of Canada

PANELISTS: **Pierre Rivard** *EXECUTIVE CHAIRMAN*
Hydrogenics

Maurice Hladik *DIRECTOR OF MARKETING*
logen Corporation

Bryan Swift *DIRECTOR OF ENVIRONMENTAL ACTIVITIES*
General Motors Canada

Graham Campbell *DIRECTOR GENERAL*
Office of Energy Research & Development, Natural Resources Canada



IVEY

Panelists CONTINUED

SESSION FOUR

Creating a Culture of Conservation: Managing Energy Demand

CHAIR: **Ken Ogilvie** *EXECUTIVE DIRECTOR*
Pollution Probe

PANELISTS: **Ralph Torrie** *VICE PRESIDENT*
ICF International

Bonnie Schmidt *PRESIDENT*
Let's Talk Science

Gary Paul *VICE PRESIDENT*
Utilities Practice, Capgemini

Guy Holburn *ASSISTANT PROFESSOR*
Richard Ivey School of Business

EVERGREEN PAPER PRESENTATIONS

Climate Constrained Energy Policies: A Modest Proposal

CHAIR: **David Moorman** *SENIOR POLICY ADVISOR*
Social Sciences and Humanities Research Council of Canada (SSHRC)

PANELISTS: **Harry Swain** *EXECUTIVE DIRECTOR*
Canadian Institute for Climate Studies, Centre for Global Studies, University of Victoria

Guy Holburn *ASSISTANT PROFESSOR*
Richard Ivey School of Business, University of Western Ontario
(with Tom Ewart, Research Associate, Richard Ivey School of Business)



IVEY

Introduction

Canada's per capita greenhouse gas emissions are among the highest in the world. However, our contribution to total global emissions is 'only' 2% - a drop in the bucket, some might argue. So why should Canada reduce its emissions, and why should we act now? A statement submitted by three participants in the Developing Sustainable Energy Policy Workshop, Geoff Cargill, Gary Paul and Gord Reynolds, answers these questions best:

"We want to lead the world in the development of cleaner, more efficient energy technologies, increase the efficiency and value of our energy-intensive industries, optimize the production and use of our vast portfolio of energy resources and improve economic and environmental outcomes for the Canadian public."

The choices that a society makes at any moment will guide its future success. Today, Canada faces important choices on greenhouse gas (GHG) emissions and its economy. Failure to take action now to achieve a low carbon energy system could have long-term economic, environmental and social impacts that can be described as chaotic at best, and possibly disastrous at worst.

Scientific consensus on climate change, its impacts and the role of man-made greenhouse gas emissions is well established. We know that global temperatures are on the rise, and that the impacts of this trend will challenge our capacity to adapt. An enormous volume of media reports is sounding alarm bells, based on new studies and heightened public concern over the predicted impacts. This intensified following the Feb. 2 release of a report by the UN's Intergovernmental Panel on Climate Change which, according to an Associated Press report, found that "man-made emissions of greenhouse gases can already be blamed for fewer cold days, hotter nights, killer heat waves, floods and heavy rains, devastating droughts and an increase in hurricane and tropical storm strength."

Canada, as a largely forested nation with vast Arctic territories, will be among the most highly impacted countries. We are already witnessing the effects of warming temperatures. For example, after several years of above-normal winter temperatures in British Columbia's interior, forests are being devastated by the mountain pine beetle. And in the Arctic, many communities are grappling with the impact of melting permafrost on pipelines, roads and buildings.

To mitigate the impacts of climate change, we know that significant reductions in greenhouse gas emissions are required. The decisions and investments we make today will have an effect on climate change for years to come. For example, the many buildings today that are not built to modern "green" standards will have an unnecessarily large GHG impact for as many as 40 years or more. Delays in making these changes now will only magnify future challenges. We must act quickly, strategically and wisely.

By taking action now, Canada can create enormous opportunities through technology development and commercialization that will drive future exports, economic growth and job creation. On the other hand, should Canada waver, we risk falling behind our major competitors, with potentially negative consequences for our competitiveness in the global economy.



Ivey

Introduction CONTINUED

Other jurisdictions have already made significant progress in addressing these same issues. The European Union's recent announcement of a long-term renewable energy plan is one of many steps it has taken. In the U.S., several Northeast states signed an agreement in 2005 for a mandatory cap-and-trade program to control carbon dioxide emissions from power plants.

Many of the policies recommended in this report are not new or unique to Canada. Perhaps best of all, some of them can be implemented relatively quickly and easily (though it must also be recognized that challenges will likely arise in developing a consensus on other solutions). While some measures can be implemented at relatively low cost, others will be expensive. In his closing remarks at the workshop, Dr. David Keith, Canada Research Chair in Energy and the Environment, stated that eliminating carbon emissions, over a timeframe equivalent to our children's lifetime, will involve annual costs of roughly the same scale as the annual cost of all other environmental compliance.

The workshop's policy recommendations are intended to set the stage for future consultations with all levels of government. Below, we have identified four overarching recommendations from the report, which we believe must be considered as part of a long-term plan to achieve a low carbon society. The full list of recommendations can be found in the main body of the report.

- 1. Financial market incentives: governments should establish an investment framework to facilitate the development and commercialization of technologies that will transform Canada's fossil fuel-based economy into a low carbon economy, and create new export, employment and economic growth opportunities**

In the workshop's first session, "*Innovation Failures and Financial Instruments Required for Market Success*," participants addressed market mechanisms, particularly financial barriers and incentives that will assist good ideas to navigate the innovation chain to become valuable and marketable solutions. Through creative energy policies that support emerging low carbon technologies, governments can provide the fiscal incentives needed to stimulate innovation, promote their early adoption and level the playing field with today's mainstream technologies. These could include tax credits for the early adoption of clean technologies, flow-through shares and refundable tax credits for capital investment in research related to low carbon solutions.

The third panel discussion, "*Hydrogen, Hybrids and Husks: Fuels for the Future*," focused on science and technology issues related to alternative, low carbon energy sources, along with policy implications for their development and commercialization. In recent decades, a new generation of transformative technologies has emerged that, if commercialized and adopted, could reduce Canada's - and the world's - dependence on carbon-based fuels. With abundant low carbon energy resources like wind and biofuels, strong technological expertise and an educated workforce, Canada has the potential not only to satisfy its energy needs with less environmental impact, but also to become a global leader in many of these technologies.



IVEY

Introduction CONTINUED

Looking beyond Canada's borders, the federal government should facilitate the export and foreign adoption of Canadian low carbon technologies. Given Canada's relatively small economy and population, those technologies would have a much larger impact on global emissions if they are implemented elsewhere.

Should Canada fall behind in the development and commercialization of low carbon technologies, we risk jeopardizing the economic, job creation and export opportunities they offer, and becoming increasingly dependent on technologies developed in other countries. With the right approach, however, Canada can fully benefit from the approaching and inevitable transition to a low carbon society.

2. Education initiatives: programs should be developed to increase public awareness on climate change in order to stimulate demand for cleaner energy alternatives, engage consumer participation in GHG reductions and create a culture of conservation among Canadians

Demand management and conservation must be a central part of Canada's energy policy. The fourth panel discussion, "*Creating a Culture of Conservation: Managing Energy Demand*," focused on the development of ideas to create a culture of conservation among energy consumers, employees, policy-makers, producers and Canada's children.

A key conclusion was that Canada must promote education initiatives that increase public awareness of climate change science and the urgency of greenhouse gas reductions, stimulate demand for cleaner energy solutions, and engage citizens in becoming active participants in the solution. An improved understanding of these issues by all Canadians will lay the groundwork for better personal, political and business decisions.

Public education initiatives should involve in-school studies on climate change and GHGs; forums for businesses to share and learn about best practices; programs to encourage the development of co-op job placements in the energy sector; and initiatives to encourage private investment by industry in marketing and educational campaigns. It should also include university and college training programs for jobs in the energy, agriculture and engineering fields as well as climate change sciences.

At the consumer level, conservation and demand-management can be supported through the deployment of "smart meter" systems to monitor home energy use, energy-saving light bulbs and appliances, and other measures.

3. Concerted, long-term action: business, government and academia must together build an integrated, long-term approach to GHG reductions that leverages the full range of policy options and involves all key players

The workshop's second panel discussion, "*No Single Solution: Determining Ontario's Optimal Energy Mix for the Future*," developed policy recommendations to help governments strategically rebalance Canada's energy mix and move toward a sustainable electricity supply. The discussion underlined the importance of recognizing that there is no single answer that will lead to a sustainable energy supply, but that an integrated set of solutions is required. The integrated plan must encompass generation, transmission and demand-management.



Ivey

Introduction CONTINUED

Many of the technologies required to reduce GHG emissions already exist. However, to encourage their widespread commercialization and adoption, Canadian businesses and governments must focus on an efficient deployment of the technologies that better integrate Canada's many energy resources. This could include, for example, increased use of wind power to supplement the base load electricity supply, whether it is hydro in Quebec or coal in Alberta. In contrast, a strategy that focuses exclusively on emissions reductions from fossil fuel combustion may succeed in lowering greenhouse gas emissions, but would do nothing to meet the longer-term need for alternative energy development.

Alongside the integrated approach essential to the development of a clean electricity supply, simultaneous efforts are required to reduce overall energy demand and improve energy efficiency. To achieve these goals, Canada will have to look beyond the fossil-fuel era in its planning horizon. This will require a long-term commitment to develop a national energy strategy supported by policies and initiatives at the federal, provincial and municipal levels.

In addition, governments should work together to provide clear and consistent market signals that demonstrate their commitment to addressing climate change. Everyone has a role to play - the private and public sectors, NGOs, academia and consumers. However, governments have the responsibility to define the rules of the game and set priorities; therefore they will play a pivotal role. As Carol Stephenson, Dean of the Richard Ivey School of Business, reminds us, businesses drive change, governments enable change.

Recent federal government announcements, such as the \$1.5 billion investment in a new ecoENERGY Renewable Initiative to strengthen Canada's renewable energy resources, are a step in the right direction. But governments can do more to improve the adoption of low carbon technologies and fast-track their implementation through policies that produce short-term results while providing long-term direction for planners, producers and consumers. As global cooperation will almost certainly become more important to future climate change solutions, today's government policies should set the stage for collaborative international efforts.

4. Ongoing public policy development: governments should continue building on GHG reduction initiatives to improve outcomes and leverage new technologies and approaches as they become available

Climate change presents an enormous and complex set of challenges for Canadian governments at all levels - challenges that cannot be solved with technology alone. Therefore, governments should not only encourage investment in the research and development of low carbon technologies, but should also sponsor research on energy policy development and related social transformation. This could include assessing the costs of climate change to Canadian businesses, governments and consumers, and measuring the impact and effectiveness of various types of tax shifting.



Ivey

Introduction CONTINUED

The workshop included a session on “Research and Evergreen Papers,” to gain a better understanding of how research can contribute to our understanding of the social, economic, political and institutional barriers to building a low carbon society. Improved knowledge, in turn, will help lead to the development of well-informed policies and effective strategies. The discussion emphasized the importance of objective, timely and relevant advice to assist government decision-making on energy policy and climate issues. Universities and colleges can play an instrumental role in this area.

It is our hope that the type of collaborative effort that shaped the Developing Sustainable Energy Policy Workshop, which drew on the knowledge and wisdom of experts from all areas of the energy sector, will guide future policy development in Canada. This kind of approach, involving both the public and private sectors, can help Canada better meet the climate change challenge. By adopting the workshop’s recommendations, we believe that Canadian governments can more efficiently and effectively solve the environmental and economic issues this country faces, and better meet the needs of our changing energy reality.

“Good public policy and effective business strategies are often best understood by leaders who have had direct experience in the worlds of government and business. One of the goals of the Lawrence Centre at the Ivey Business School is to seek out such leaders and ensure that their views are heard and debated.”

Thomas d’Aquino CHAIR, LAWRENCE CENTRE ADVISORY COUNCIL



IVEY

Summary of Recommendations

SESSION ONE

Innovation Failures and the Financial Instruments Required for Market Success

The following recommendations illustrate how creative economic policies could release and redirect capital to improve energy technologies.

DEVELOP CONSISTENT NATIONAL AND PROVINCIAL ECONOMIC POLICIES THAT SUPPORT THE STRATEGIC IMPORTANCE OF SUSTAINABLE DEVELOPMENT TECHNOLOGIES IN CANADA AND GLOBALLY

- We recommend the use of sustainable development technologies to stimulate Canada's international competitiveness and increase our exports. This would release resources that could be committed to addressing the significant and pressing environmental problems of emerging economic regions.
- Canada must use all of its economic levers to shift the balance of investment, infrastructure development, taxation, regulation, and incentives to emphasize sustainable development technologies.
- Federal and provincial governments must work together to send a clear market signal that they are committed to addressing climate change and environmental problems. For example, harmonizing regulatory and policy scenarios across provinces (e.g., local content rules) will attract domestic and foreign investment.
- Develop consistent terminology to improve communications in this area, especially among federal and provincial government agencies. We recommend the Cambridge and Israeli technology taxonomies be reviewed as effective examples.

USE TAX LEVERS TO ENCOURAGE THE CAPITAL MARKET TO REDIRECT FUNDS TO SUSTAINABLE TECHNOLOGIES

- Utilize tax shifting as a means of giving price signals to the capital market.
- Introduce an Innovation and Productivity Tax Credit (IPTC) for the clean tech sector. This tax incentive would reduce risk and increase reward for angel investors, who are currently an untapped pool of capital for closing the pre-commercial investment gap. An IPTC could be funded by federal and provincial governments.
- Expand federal regulation to the Scientific Research and Experimental Development (SR&ED) tax credit program to provide refundable tax credits for Canadian public companies that are developing Intellectual Property (IP) in this country.

FACILITATE TECHNOLOGY TRANSFER FROM PUBLIC RESEARCH AND DEVELOPMENT (R&D) TO THE PRIVATE SECTOR

- Review national innovation policy to develop an action plan for improving technology transfer from the academic and research sector to the private sector.
- Engage the private sector to educate the R&D community on market reality, returns, and the need to move from incremental improvement to disruptive technologies that engender greater profitability.
- Develop explicit incentives for international technology transfer, such as facilitating IP exchange.



IVEY

Summary of Recommendations CONTINUED

TARGET PUBLIC SECTOR INVESTMENT TO CLOSE GAPS IN THE INNOVATION CHAIN

- Encourage federal and provincial governments to fund R&D at the pre-commercial stage, which is currently the weakest link in the innovation chain. Pre-commercial R&D is usually too risky to attract private sector investment. We recommend the Sustainable Development Technologies Canada (SDTC) model, which has successfully leveraged tax payers' dollars and engaged funds from the private sector.
- Repeat the success of the British Columbia (BC) direct investment model by adopting it in all provinces and developing an equivalent at the federal level.
- Implement the recommendations of the 2004 Canadian Task Force on Early Stage Funding.

ENCOURAGE FOREIGN INVESTMENT BY REMOVING IMPEDIMENTS TO CO-INVESTING WITH CANADIAN COMPANIES

- Enable flow-through status or treaty benefits for U.S. limited liability companies that invest in Canadian companies.
- Remove the disclosure requirements under Section 116 of the Federal Income Tax Act for private capital investors.
- Redefine the Canadian Partnership approach that currently becomes non-viable if one of the partners is not a Canadian resident.
- Strengthen the cross-border share-for-share exchange treatment to enable direct roll-over for Canadian shareholders selling to a U.S. acquirer.
- Remove tax withholding requirements on non-resident sales proceeds (Sect. 116).
- Review aspects of tax withholding on interest and dividend payments so that Canadian companies in receipt of U.S. funding might avoid U.S. registration.

REMOVE REGULATORY CONSTRAINTS TO RELEASE PROJECT FINANCE

- Encourage the participation of developers with Wind Power Purchase Incentives (WPPI), ensuring that they receive the WPPI payment directly by precluding provincial utility companies from accessing them.
- Allow WPPI and flow-through deductions to exist in the same project structure.
- Improve the efficiency of the capital market by enacting the recommendations of the National Round Table on the Environment and the Economy Capital Market (NRTEE) and Sustainability Report.
- Harmonize renewable portfolio standards across provinces and with the U.S.
- Strengthen treatment for flow-through legislation for Class 43.1 by:
 - *broadening eligibility requirements to include thermal applications (e.g., ground source heat pump) which reduce urban environmental impacts by addressing constrained generation and transmission;*
 - *supporting high capital expenditure (high capex), low carbon projects (e.g., bio-fuels);*
 - *changing the definition of commercial projects to simplify project permit requirements;*
 - *enabling SDTC-like projects to be supported in international locations by allowing Canadian developers to benefit from flow-through share treatment.*



IVEY

Summary of Recommendations CONTINUED

SESSION TWO

No Single Solution: Determining Ontario's Optimal Energy Supply Mix for the Future

In the next five to twenty years, Ontario must significantly increase its electricity generation capacity to accommodate increasing demand and to replace high-emission coal-fired and end-of-life generation facilities. The following recommendations illustrate how Canada, in particular Ontario, could strategically combine its energy mix and move towards a sustainable electricity supply.

TAKE A STRATEGIC RATHER THAN REACTIVE APPROACH TO ENERGY TRANSMISSION AND DISTRIBUTION

- Transmission infrastructure has long lead times. The province must identify and construct transmission projects as early as possible and streamline the regulatory approval process so that transmission is available when needed. For instance, in other jurisdictions, transmission is built in anticipation of generation.
- Mandate the Ontario Power Authority (OPA) to prioritize its numerous, small, renewable projects so that Hydro One can focus on the most economically viable options.

EDUCATE ALL CANADIANS ABOUT THE IMPORTANCE OF A LOW CARBON SOCIETY

- Educate consumers, especially youth, to conserve energy.
- Encourage academics to contribute to evidence-informed policy development at all levels of government.
- Recognize that oil and gas producers are as much a part of the solution as they are a part of the problem. Actively discourage producer behaviour that is based on an obligation to serve or driven purely by commodity pricing. Encourage producers to minimize the negative impact of their technologies (e.g., carbon capture and sequestration).

DEVELOP AN ECONOMY BASED ON LOW CARBON ENERGY SOURCES BY ENCOURAGING INNOVATION AMONG PRODUCERS

- Assess the potential of clean-coal technologies. With the right investment, many existing facilities can perform more efficiently.
- Use life cycle methodology to evaluate renewable energy options. For example, the costs of solar energy should include the environmental impact of producing silicon; the costs of wind power should include the transport costs of constructing windmills.
- Include the environmental and social impacts of fossil power when evaluating the overall cost of electricity, either through taxation or carbon trading markets.

FOCUS ON REDUCING GREENHOUSE GASES (GHG)

- Governments must find ways to send credible long-term signals to help the private sector make investment decisions that take account of GHG reductions.
- Provinces can take advantage of the significant social, environmental, and economic benefits that accompany decreased GHG emissions, such as reducing air pollution and marketing clean energy technologies.



IVEY

Summary of Recommendations CONTINUED

SESSION THREE

Hydrogen, Hybrids, and Husks: Fuels for the Future

Over the last few decades, a new generation of transformative technologies has emerged that could reduce our dependence on carbon-based fuels. The following recommendations illustrate how Canada can take advantage of the latest developments in low carbon energy science.

USE GOVERNMENT POLICY LEVERS TO STIMULATE FURTHER R&D

- Increase private sector R&D investment with R&D tax credits and other investment mechanisms that help companies manage technological risk more effectively.
- Stimulate demand for new sustainable energy technologies by levelling the playing field and lowering investment risks for early adopters.
- Create designated districts or parks for fast-track adoption of new energy technologies, for example the Hydrogen Village in Toronto or the Bruce Eco Industrial Park in Kincardine.
- Encourage more R&D on plug-in hybrid and pure electric vehicles, particularly to address battery costs, weight, and capacity issues. Well-to-wheel analyses are positive, provided there is a low-emission source for the charging current.
- Create Canadian successes on the world stage by facilitating international agreements and collaborations to advance high-volume manufacturing, commercialization, and market access. We recommend the U.S. Freedom Car Initiative model.
- Continue to participate in multilateral (e.g., International Energy Agency) and bilateral (e.g., US Department of Energy) projects on a portfolio of emerging technologies matched to prospects in domestic and foreign markets.

REDUCE THE BARRIERS TO COMMERCIAL ROLLOUT OF NEW TECHNOLOGIES

- Help firms access the resources they need to roll out new technologies, including infrastructure such as water, gas, transportation, and electricity.
- Provide a supportive investment climate for large-scale industrial development of alternative energy sources.



IVEY

Summary of Recommendations CONTINUED

SESSION FOUR

Creating a Culture of Conservation: Managing Energy Demand

Our rapidly changing natural, economic, and social environment has forced us to rethink our perspective on energy. The following recommendations summarize our ideas on how we can create a culture of conservation among customers, employees, policy-makers, producers, and our children.

GATHER AND ANALYZE INFORMATION TO BETTER UNDERSTAND AND MANAGE THE DEMAND FOR ELECTRICITY

- Develop information databases to analyze energy demand, explore the size of the demand/supply management 'reserve', assess the risks of new power supply projects, and understand the dynamics of electricity demand.
- Identify researchers and practitioners who can advise the government on environmental, energy, and climate change issues in an objective and timely manner.
- Review the assumptions underpinning current demand forecasts and the electricity productivity gap. Exploit and capture energy efficiency gains so that we don't repeat the over-investment mistakes of the past.

ALIGN GOVERNMENT FUNDING TIME HORIZONS TO THE DURATION OF ENERGY MANAGEMENT PROGRAMS

- Many programs require upfront capital and on-going investment. Customers, suppliers, and utilities incur costs over a period of time (e.g., smart metering and integrated remote monitoring and management systems). Government funds that aim to encourage such investments should allow the recovery of costs during the lifetime of energy projects rather than simply the initial capital expenditures.
- Uncertainty over government funding policies (e.g., funding amounts, eligibility, compensation methods, time horizons) discourages investment in energy management programs. This is particularly pronounced for large investments over multiple years. Explicit and specific government commitments to policy goals and administrative mechanisms will reduce the perceived risks associated with government funding.

DEVELOP ENERGY MANAGEMENT TECHNOLOGY THAT IS EASY FOR CONSUMERS TO USE

- New energy management tools (home displays, smart thermostats and timers) need to be simple, accessible, and automatic. The customer cost savings of installing a Smart Meter do not accrue immediately, but accrue from consumers changing their consumption patterns. New technology needs to focus on ensuring that customers perceive value sooner rather than later.



IVEY

Summary of Recommendations CONTINUED

LEVERAGE AND REWARD BEST PRACTICES AND INNOVATION

- Organizations that are focused on developing their core competencies may not appreciate the potential financial benefits of conserving energy, or have the managerial resources to investigate them. The government can address this by publicizing the achievements of firms and households that have adopted energy management programs. One approach is to fund industry-focused learning communities in which experienced managers share their knowledge about energy management with similar organizations (e.g., hospitals).

EDUCATE THE NEXT GENERATION OF ENERGY USERS

- Develop common messages, goals, and objectives for Kindergarten-Grade 12 education curricula. For example: “What does it mean to have a conservation culture? What knowledge, attitudes, and skills will youth require?”
- Expect school leaders to establish a culture of conservation in their schools.
- Provide teachers with resources and training on energy conservation during teacher education and in the classroom.
- Establish a national sustainable technology education fund (see the STDC model) to encourage innovation and novel partnerships between schools and the private sector. Aim for energy-literate children within the next 15 years.
- Build and retrofit school facilities to incorporate conservation practices.

ADDRESS THE IMPENDING HUMAN RESOURCE SHORTAGES IN THE ENERGY SECTOR

- Create educational programs and partnerships with industry to train the next generation of skilled workers. Specific critical shortages have been identified (e.g., nuclear sector).
- Evaluate the need for new programs in universities and encourage co-operative placements to develop skilled workers needed for the energy sector. (e.g., London Hydro has created new apprentice positions, recognizing it's ageing workforce.)
- Encourage innovative and novel partnerships between schools and the private sector to generate a variety of programs to ensure the development of an “energy literate” workforce.

SPECIAL SESSION ON RESEARCH AND EVERGREEN PAPERS

Despite the great deal of research that has been conducted on climate change and the possible paths to a low carbon society, it is often difficult to assess the research results in this fast moving field of study in a way that is useful, pragmatic and comprehensive. The following recommendations illustrate how academic research can be conducted and mobilized to assist governments in public policy development and implementation.

SUPPORT PUBLIC POLICY DEVELOPMENT

- Determine methods to mobilize the knowledge, expertise and investigative capacity of the academic community.
- Encourage research focused on exploring questions of immediate relevance that will address a wide variety of crucial issues related to both technology development (e.g., carbon capture & storage) and the social, economic, cultural and legal aspects of moving away from fossil fuels towards low carbon sources and carriers of energy.



Session One

Innovation Failures and the Financial Instruments Required for Market Success

Vicky J. Sharpe PRESIDENT AND CEO
SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA (SDTC)

CONTEXT

The underpinnings for developing energy policy, to incent the development and market adoption of improved energy technologies, are predicated upon attracting sufficient investment that focuses on the target technologies. Session one addressed the availability of capital and how that can be influenced through creative energy policies.

The panel addressed market mechanisms and, in particular, financial barriers and opportunities to ensure that good ideas are developed through the innovation chain, therefore becoming valuable technology solutions that will successfully penetrate markets. This would result in creating profits and providing environmental and health benefits to Canadian businesses and the public. The underlying premise is that financial markets are critical to the success of any market transformation and, because of its early stage of development, particularly so for emerging low carbon technologies.

FRAMEWORK

The innovation chain, shown in Figure 1, is a cyclical process with multiple feedback loops that details the progress of a concept through various levels of research, to technology development and demonstration, followed by product commercialization and development prior to market entry. The associated risk profiles, typically characterized as technology, financial and market risks, define the nature and extent of the different parties required to turn a good idea into a marketable product that provides returns to these players.

Typically greater risks are taken by institutions serving the public good, which are not directly affected by the pressures of shareholder returns. Therefore, the primary players at the fundamental research end of the chain are governments, academia and in some cases the private sector where the technology meets a specific business need or exposure. As a technology becomes better understood, and moves from the research bench towards an emerging product that is focused on specific applications or markets, the degree of technology risk declines.

FIGURE 1

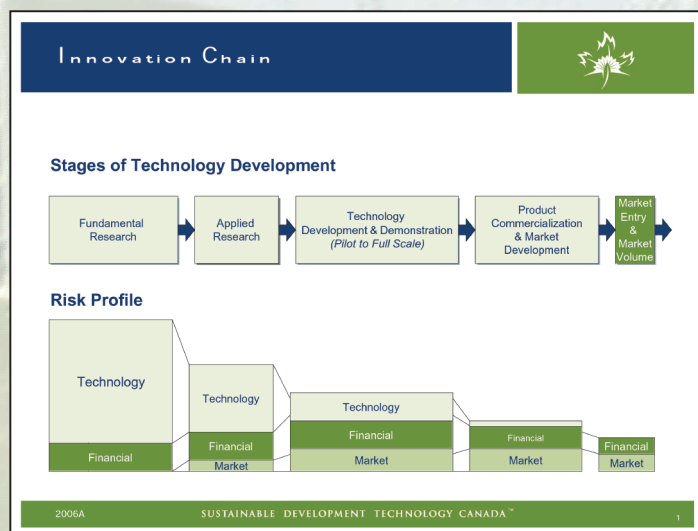
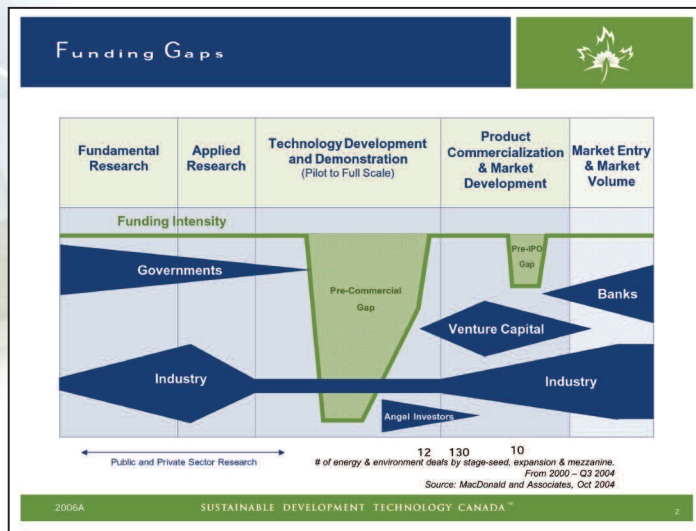


FIGURE 2



At the development and demonstration phase, the different risks have equal impact. The financial sector, driven by the requirements for returns accepts limited or no technology risk while it focuses efforts on addressing product commercialization and market development activities. Even beyond the point of market entry there remains some market acceptance and financial risk. The primary players in the innovation chain and their placements on that chain are depicted in Figure 2. If one maps the availability of risk capital to fund the expensive development and demonstration phase, as illustrated by the funding intensity line, it can be seen that there is a lack of capital at this stage which is called the pre-commercialization gap or the “valley of death”.

There is a second gap classified as the pre-initial public offering (IPO) gap caused by market caps in Canada that constrain revenues and the ability of small and medium sized companies to attempt the classic IPO route to market.

At the pre-commercial stage there is both a funding and a capacity gap where many start-up companies do not have the experience or capacity to attract venture capital (VC) which requires greater returns than are possible at this point. Sustainable Development Technology Canada (SDTC) was set up to bridge this gap, thereby reconnecting the innovation chain in the sustainable technology, or clean technology (clean tech) space. SDTC’s experience is that 90% of the projects that it funds are led by small and medium sized enterprises (SMEs) who are in need of financial and business support.

At the national level, this break in the innovation chain has significant consequences on the competitiveness of Canada’s economy. Data shows that for every research dollar spent in Canada one dollar of profit is obtained, while in the U.S. there is a one-to-three ratio. In this latter case, profits can be returned to the innovation chain attracting more opportunities and reducing the risk profile for investors.

There is also an imbalance in the level of effort/funding across the innovation chain. While it is not possible to collect accurate data on monies invested by industry, approximately \$23 billion is invested in Canada annually in research and early stage development while the VC industry, on average, places \$2.3 billion into the innovation chain. VC returns in Canada are significantly lower than in the United States, which helps to drive capital further downstream where uncertainty is less, resulting in a wider pre-commercial gap.

This situation is exacerbated for emerging clean technologies which could be classified as being at a similar state of evolution as biotechnology was some 20 years ago. There are many misconceptions around the nature and viability of the clean tech space, although it is hampered by the fact that its technologies can be found in the broad range of market sectors, therefore making it harder to define and track performance. However, in the last five years, 50% of the clean tech dollars have been directed towards technologies in the energy field and advanced materials.





In Canada, in the development and demonstration area, SDTC's portfolio of some \$860 million represents over 100 technology solutions relevant to primary economic sectors in Canada¹. Another emerging trend is that while Canada has a significant number of small companies in this sector and was keeping pace with the U.S. in relative levels of investment in this space, the last few years have seen us fall behind, and our competitive edge is at great risk. A fundamental approach to address this critical issue is to mobilize the participation of private sector finance focused on clean technology. Therefore, this session addresses these areas which are relevant to innovation in general.

The panel described examples of what is working and what is not when it comes to encouraging investments in energy technologies from the different perspectives and the needs that are specified according to their placement on the innovation chain. Their suggestions for financial instruments and regulations with the consequent policy implications were discussed.

The panel addressed two fundamental questions:

1. **How do we increase the availability of risk capital and strengthen investor appetite for clean technology to deal with the associated or perceived risks?**
2. **What policies are required to mobilize more capital to support market entry of clean technologies so that Canada can become more economically and environmentally viable?**

The presentations were focused on key steps in financing the innovation chain.

THE BEGINNING OF THE EARLY STAGE CONTINUUM: PRE-SEED AND SEED STAGE

In discussing the pre-seed and seed stage of the innovation chain, the higher risk areas where governments and angel investors² are involved, Mr. Andrew Wilkes, Founding Member and Chair, National Angel Association, addressed the importance of angel investors and how to mobilize them to this space. Mr. Todd Tessier, Senior Portfolio Manager, British Columbia Ministry of Small Business and Economic Development, described a successful BC provincial incentive program that has helped create and build innovative SMEs.

SEED, STARTUP AND EARLY REVENUE STAGE

VC (in addition to angels and angel groups) typically finances the bulk of the early stage continuum. Mr. Michael Brown, Chairman, Chrysalix Energy Management Inc., looked at a range of capital market and research options for sustainable development and addressed VC and potential significant future disruptions caused by climate change. Mr. Tom Sweeney, General Partner & Managing Director, Garage Technology Ventures Canada, looked at Canadian returns and investment approaches compared with those of the U. S., as well as barriers to cross-border investments. He also discussed the notion of value innovation and the fundamental role that intellectual property transfer plays in the productivity agenda.

¹The breakdown of SDTC's funding by sector portfolio is as follows:

Energy Exploration and Production - 24% - \$42,178,192 • Power Generation - 16% - \$27,006,556
Energy Utilization - 25% - \$42,918,120 • Transportation - 12% - \$19,963,280 • Agriculture - 5% - \$8,449,539
Forestry and Wood Products* - 9% - \$14,455,789 • Waste Management - 9% - \$14,870,564

*Complete sector name: Forestry, Wood Products, and Pulp and Paper Products

²Angel investors are private, individual investors who invest their own money. As an investment class, angels are typically amongst the first investors who screen and finance Canadian innovation and therefore lie at the heart of the early stage continuum and play a fundamental role in the national debate on innovation, productivity and competitiveness.





LATER STAGE COMMERCIALIZATION AND INTERNATIONAL GROWTH

Finally, in the area of project finance, which is particularly important to the commercialization of many capital intensive renewable energy technologies, Mr. Bill Tharp, Managing Partner, Quantum Leap Co., spoke to the policy options currently available. He addressed issues with inequalities in current energy tax incentives between conventional and new clean technologies, including the need to attract international investors.

The combined set of policy opportunities described by the experts will enable better linkages and improved performance for investment in this country.³

RECOMMENDATIONS:

The following recommendations illustrate how creative economic policies can release and redirect capital to improve energy technologies.

Overarching National Considerations

- Federal and provincial governments should work together to send a clear market signal to address climate change and the environment.
- Shift the balance of investment, infrastructure development, taxation, regulation and incentives to emphasize the development and availability of sustainable development technologies. Avoid repeating historical failures associated with the environment by spending money and resources early in order to avoid environmental disasters, rather than spending much more money and effort resolving problems after the fact.
- Use the knowledge and technology developed as a result of this strategic focus to increase Canada's international competitiveness, increase exports and thereby help to address the far more significant, imminent environmental impact among the emerging economic giants such as China, India and Russia.
- Employ tax shifting as a means of giving price signals to the capital market, thereby redirecting funds to sustainable technologies.
- Ensure that policy design addresses the need to attract foreign investment.
- Develop explicit incentives for international technology transfer including facilitating IP exchange.
- Implement a national awareness and education program to educate the public on the future impacts of climate change.

For developing and demonstrating low carbon technologies:

- Encourage federal and provincial governments to fund R&D at the pre-commercial stage, which is currently the weakest link in the innovation chain. Pre-commercial R&D is usually too risky to attract private sector investment. We recommend the Sustainable Development Technologies Canada (SDTC) model, as it has proven to be successful, accountable and transparent and has successfully leveraged tax payers' dollars and engaged funds from the private sector.

³For more information on the policy opportunities described in this session reference the document "Presentation Summaries: Innovation Failures and the Financial Instruments for Market Success" posted on the Lawrence National Centre's webpage: www.ivey.uwo.ca/lawrencecentre/energy/report.htm .





For pre-seed angel investment:

- Introduce an Innovation and Productivity Tax Credit (IPTC)⁴ targeted at the clean tech sector. This tax incentive would reduce risk and increase reward for angel investors, who are currently an untapped pool of capital for closing the pre-commercial investment gap. An IPTC could be funded by federal and provincial governments.
- Expand federal regulation to the Scientific Research and Experimental Development (SR&ED) tax credit program⁵ to provide refundable tax credits for Canadian public companies that are developing IP in this country.
- Repeat the success of the BC direct investment model⁶ by adopting this in all provinces and develop an equivalent at the federal level.

For the venture capital community across all stages:

- In the process of developing policy, define national terminology to improve communications in this area. Consistency in technology terminology⁷ should be applied to the federal government and its agencies such as Statistics Canada (templates can be derived from the Cambridge and Israeli technology taxonomies⁸).
- Undertake a national innovation policy review focused on defining an action plan for improving technology transfer from the academic/research system to the private sector. Couple this with education of the research and development (R&D) community by the private sector on market reality, returns and the need to move from incremental improvement to disruptive technologies that engender greater profitability.
- Implement the recommendations of the 2004 Canadian Task Force on Early Stage Funding⁹.
- Have the federal finance and industry departments remove impediments to co-investing with Canada by foreign investors. These should include:
 - *Enable flow-through status or treaty benefits for United States limited liability companies (LLCs) that invest in Canadian companies;*
 - *Remove the disclosure requirements under Section 116 of the Federal Income Tax Act for private, capital investors;*
 - *Redefine the “Canadian Partnership” approach that currently becomes non-viable if one of the partners is not a Canadian resident;*
 - *Strengthen the cross-border share-for-share exchange roll-over treatment to enable direct roll-over for Canadian shareholders selling to a U.S. acquirer;*

⁴For more information reference the Innovation and Productivity Tax Credit (“IPTC”) Overview authored by The National Angel Organization: www.irun.com/users/7439/downloads/IPTC%20Overview.pdf .

⁵For more information reference Canada Revenue Agency’s Scientific Research and Experimental Development (SR&ED) program description at: <http://www.cra-arc.gc.ca/taxcredit/sred/aboutus-e.html> .

⁶More information on the BC Direct Investment Model is available upon request from the Lawrence National Centre.

⁷Pre-Seed and Seed, for example, should be defined by the point where IP is legally assigned or licensed into a startup and not by how much money is raised: this puts a bright spotlight onto IP Transfer practices and the marketing of publicly funded IP to investors: two areas in need of policy attention.

⁸For more information on the Cambridge taxonomy reference: www.libraryhouse.net/publications or for more information on the Israeli taxonomy reference: www.light-speed-analyst.com . More information is available on request at the Lawrence National Centre.

⁹For more information on the 2004 Canadian Task Force on Early Stage Funding reference “Canadian Ventures: Barriers to Success in Risk Capital Markets” available on the Lawrence National Centre’s website: www.ivey.uwo.ca/lawrencecentre/energy/report.htm .





- Remove tax withholding requirements on non-resident sales proceeds under Section 116 of the Federal Income Tax Act;
- Review aspects of applying withholding taxes on interest and dividend payments that will reduce the imposition of U.S. registration by Canadian companies in receipt of U.S. funding.¹⁰

For the project finance community:

- Many clean technologies are capital equipment intensive and do not take the venture capital path to market. Therefore, financial instruments and policy options are necessary if this large source of environmental benefit, one that primarily addresses the resource sectors, is to be accessed.
- Strengthen treatment for flow-through legislation. For Class 43.1¹¹, undertake the following:
 - Broaden eligibility requirements to include thermal applications (e.g., ground source heat pump) which reduce urban environmental impacts because it addresses the constrained generation and transmission market;
 - Enable support for high capital expenditure (high capex) low carbon projects (e.g., many of the bio-fuels and energy exploration and production projects in SDTC's portfolio);
 - Modify the definition of commercial projects to simplify project permitting requirements;
 - Allow international project development by Canadian developers to receive benefits from the flow-through share treatment (e.g. enable SDTC like projects to be supported in international locations).
- Encourage the participation of developers with Wind Power Purchase Incentives (WPPI)¹², ensuring that they receive the WPPI payment directly by precluding provincial utility companies from accessing them.
 - Allow WPPI and flow-through deductions to exist in the same project structure as they are currently mutually exclusive.
- Enact recommendations to improve efficiencies in the capital market as recommended by the National Round Table on the Environment and the Economy (NRTEE), described in the NRTEE Capital Market and Sustainability Report.¹³
- Harmonize renewable portfolio standards across provinces and with the U.S.

¹⁰These policy options and more are described in a report submitted to the Canada-California Cross Border VC and IP Working Group - June 2006. This report is available at the Lawrence National Centre upon request.

¹¹The Government of Canada's Tax Incentives for Business Investments in Energy Conservation and Renewable Energy document describes Class 43.1 as an accelerated rate of write-off for certain capital expenditures on equipment that is designed to produce energy in a more efficient way or to produce energy from alternative renewable sources. Class 43.1 allows the deduction of the cost of eligible equipment at up to 30 percent per year, on a declining balance basis. Without this accelerated write-off, many of these assets would be depreciated at annual rates of 4, or 20 percent (with the exception of expenses eligible for the pre-existing Class 34, which were deductible at an annual rate of up to 50 percent).

¹²For information on Wind Power Purchase Incentives visit: www.canren.gc.ca/programs/index.asp?Cald=107.

¹³More information on this report is available upon request from the Lawrence National Centre.





DISCUSSION AND SELECTED QUOTES

The discussion following the presentations focused on a number of issues including:

))) **Economic viability of ethanol as a primary fuel**

"I'd be interested to know the panel's view of ethanol. As an outsider, looking at what's happening in the U.S. with ethanol and Canada's little blitz to get into that space... if you see that as something that's going to address these bigger challenges of global warming...there is a body of evidence that would suggest we haven't yet done enough analyses in that..."

Alan Wildeman UNIVERSITY OF GUELPH

"I think that ethanol from food is dumber than a sack of hammer handles. I think that possibly making ethanol from cellulose makes some sense...In Brazil its happening because Brazilians decided that they didn't want to be held hostage to the world energy crisis... In the United States, I think that one of the things that has happened is that capital markets have endorsed the idea to the point of absurdity... if anything, I think we're over-invested in ethanol... replacing 10% of the American's fuel demand (imported fuel demand) with ethanol would require 30% of the arable land in the United States. That doesn't strike me as being part of a particularly long term answer."

Michael Brown CHRYSALIX ENERGY VENTURE CAPITAL

"The further north you go the less sugar plants can make, so it doesn't make sense for Canada to support ethanol production using sugar in plants. You can grow switch grass in lands that the farmers have been paid to lay fallow and it wouldn't compete with food. It just about makes sense in the U.S. ... in Canada for every unit of ethanol fuel produced you would be investing 0.85 units of fossil energy. The GHG benefit is only 15%. That doesn't make sense here as a GHG control strategy, although, the federal government is being extraordinarily generous to this option."

Hadi Dowlatabadi UNIVERSITY OF BRITISH COLUMBIA

"You asked what the motive was for the ethanol program. There is a small but significant international element to it... with respect to negotiations in international trade, everyone wants to keep their agricultural subsidies. So the secret then is how we can repackage what we're doing in agriculture... if there's a certain amount of corn and canola production in the United States and if you have it being used as another product as opposed to just principally animal feed...then you drive the price up. So there is also an element of international trade here."

Colin Hunt CANADIAN NUCLEAR ASSOCIATION

))) **Improving IP licensing in Canada**

"I heard one of the speakers focus on the importance of integrating public and private support... It seems to me that you do need to do things in a much more integrated deal-to-deal basis where all the players work together towards common objectives. This would contrast to the approach we often take where each department and private lender acts separately on a project-by-project basis. The second area that really touched a chord with me was IP licensing. I believe we need to find ways in Canada for a lot more IP flexibility, ensuring that there are real incentives to commercialize... how do we do a better job at IP licensing in Canada?"

John Knubley NATURAL RESOURCES CANADA





"We must specifically acknowledge the critical roles that, firstly, better knowledge of IP strategy and, secondly, more effective Technology Transfer, play in building sustainable Canadian companies. Too many Canadian startups do not know the difference between first-to-file and first-to-invent, or the 12-month patent bar rules, or what FTO analysis means. At the policy level, transferring innovative IP from publicly funded R&D into the private sector is clearly one of the most critical, under-examined and regionally variable links in the Canadian innovation chain. A review of best practices in IP Transfer and a proposal for a Cross-Border IP Protocol is the subject of a comprehensive study being done by the VC & IP Working Group of the Canada-California Strategic Initiative Partnership initiative."

Tom Sweeney GARAGE TECHNOLOGIES VENTURES CANADA

))) Stimulating investor interest

"I think that Canadian investors are certainly, from a public markets perspective, open to investing in a wide variety of technologies... The challenge we've had is getting companies to the stage where they are developed enough to have a significant appetite for capital to come to the public markets... so I would certainly encourage entrepreneurs to look at a variety of financings, from VCs and institutional investors, to try to build up that skill and certainly focus on an international market..."

Stephen Shapiro BMO CAPITAL MARKETS DIVERSIFIED INDUSTRIES GROUP

"I don't think there's an investor in this room or a startup company that really doubts the Canadian public's interest in supporting the development of technology in this country. The challenge is what we are doing with the technology we are developing... our national productivity and company creation track records are screaming at us to revisit our current assumptions and policies towards the innovation continuum... 3% is staring at us in the face¹⁴. Why is this so, particularly if we are leading the G8 in R&D spending? We need to revisit who chooses what defines innovation at the seed stage and apply fiscal policy to entice angels, angel funds and larger private funds (with their first-hand corporate experience and networks) to make more of these critical first cash calls: like they do in the States. We must fix our protectionist cross-border investment laws. We need to revisit technology transfer policy and the entire concept of better marketing of the great IP in our labs to more experienced investors... if we want to improve productivity levels and investor returns in Canada... we need to bring the highest possible company experience and market development expertise to bear on innovation as early as possible."

Tom Sweeney GARAGE TECHNOLOGY VENTURES CANADA

"You have the side that says we do need more C-stage [commercialization] financing, better entrepreneurs, better companies. But we do have a capital formation problem and that 3% is not just that we're not building enough of the next great wave of companies; we have too many small undercapitalized funds in this country... I follow the Life Sciences industry quite closely and it is a problem when you get some real promising companies with great science and you watch comparable companies in the U.S. with lower quality, but because they have the capitalized funds they can just jump ahead of the Canadian company by milestones."

Todd Tessier MINISTRY OF ECONOMIC DEVELOPMENT, PROVINCE OF BRITISH COLUMBIA

¹⁴The Canadian Venture Capital Association reported in June 2006 that the ten-year average return for Canadian VC funds is 3%. This compares poorly to returns of 27% for United States VC funds and 54% for Silicon Valley VC funds over the same period. (A return of less than 15% - 20% would be considered poor by foreign investors and most non-governmental Canadian institutions with investment allocations to venture capital.)





))) **Impact of subsidies**

"... for a variety of reasons we are seeing the subsidies for solar and other technologies at the consumer level. If those subsidies sit on an equal par for what went into the nuclear industry, oil and gas industry, and all the rest of it were put into alternative technologies at the same level, on the same playing field, then maybe we wouldn't need the consumer subsidies."

Marion Fraser ONTARIO MINISTRY OF ENERGY

))) **Emerging impacts of global warming**

"The northern permafrost is melting so fast that Science magazine estimates that within the next 100 years the release of CO₂ and methane could match aggregate human GHG emissions. If so, this would mean that accumulative concentrations will not stabilize at less than 900PPM, or between three to four times pre-industrial levels, accompanied by very big temperature shifts in Canadian territory. About 30% of the permafrost is in Canada. Canada's most important contribution to the science of climate change will be to measure the rate at which the billions of tons of carbon dioxide and methane in the permafrost will melt into the atmosphere..."

Michael Brown CHRYSALIX ENERGY VENTURE CAPITAL

))) **Is the solution a hydrogen economy?**

"...we've developed a great fuel cell and hydrogen industry... but this country is not big enough to get the volumes right. So what do we have to do? We have to know what our markets are... It's called China. We have to figure out a way to actually partner with the Chinese to take the technology we've got, take it there to turn it into real products. So this is where Canada's a demonstration site...We do have access to great technology..."

Michael Brown CHRYSALIX ENERGY VENTURE CAPITAL

"It's the hydrogen economy, it's the ethanol economy, it's the ground source heat pump sector, it's absolutely everything... however, whatever technologies or solutions that are pursued need to work in harmony for the long-term... build on one another... but you do hear "oh, it's the hydrogen economy". The capital markets respond to simple, concise messages. For example, "solar is hot" in Europe and has now been for some time. Ethanol is "hot in the United States" and now in Canada. Unfortunately, investments often tend to be very much fad driven and many of the projects in this industry require a lot of capital – these are critical factors to consider when you're establishing legislation..."

Bill Tharp QUANTUM LEAP COMPANY

"...ultimately it is less important to debate the priority of one technology over another and far more critical for all the key players to work together, whether it be the federal government, provincial governments, capital markets, businesses, entrepreneurs and private investors. We need to coalesce and move ahead urgently. Through inaction we are throwing away opportunities and capabilities in Canadian clean tech that can increase the productivity and competitiveness of our economy both domestically and internationally."

Vicky Sharpe SUSTAINABLE DEVELOPMENT TECHNOLOGY CANADA (SDTC)



Session Two

No Single Solution: Determining Ontario's Energy Supply Mix for the Future

CONTEXT

We are at a crossroads for determining the best energy mix for Ontario, at a transition point, moving from fossil fuel dependent energy supply to one that incorporates a multitude of possibilities, including a renewal for nuclear power. The keys to supply must be maintaining the economy's competitiveness, providing a different kind of energy "security", being environmentally sensitive and progressive and ensuring reliability.

OBJECTIVES AND FOCUS

The purpose of this panel discussion was to examine paths to a sustainable energy supply mix, specifically electricity supply. Panel participants were asked the question:

How can the components of the supply mix work together to put Ontario on the path to sustainable electricity supply?

It should be noted that in speaking about solutions to determine Ontario's optimal energy supply mix for the future, much of the presentations and discussions were focused on national considerations for decision-making, upon which all provinces can use as guidance in determining an optimal energy supply.

PAMELA NOWINA VICE-CHAIR, ONTARIO ENERGY BOARD (OEB)

Sustainable electricity supply is a critical subset of energy supply. The International Energy Agency's world energy outlook identifies electricity as the largest driver of demand growth for all primary fuels, except oil. Therefore, a sustainable electricity supply is a cornerstone of a sustainable energy supply. Ontario faces a huge challenge of replacing 80% of its existing generation capacity over the next 15-20 years. The Ontario government has determined the fuel mix that will meet the need for this capacity. The Ontario Power Authority (OPA) must develop the plan, called the Integrated Power System Plan (IPSP), to meet that fuel mix. The Ontario Energy Board (OEB) has been empowered to conduct a full public review of that plan to determine if it meets the government's directive and is economically prudent.

The government has given the OEB a new mandate to consider environmental matters as part of the review. The Board does not normally consider environmental reviews under its electricity regulation mandate.

"If Canada cannot do this (create a low carbon society) with our high level of education and prosperity, per-capita income and our level of knowledge, who else in the world could we possibly look to for leadership on this issue?"

Glen Murray
NRTEE



The key elements of the Ontario government directive setting the requirements for the new power system plan are:

- A major emphasis on conservation
- A doubling of generation capacity of renewable resources
- A requirement to eliminate coal-fired generation in a practical timeframe
- A direction to use natural gas in high efficiency and peaking applications
- A direction to build the necessary transmission facilities to deliver electricity
- A directive to cap nuclear generation at its current capacity

The electricity supply system is complex and each of the directions is very significant in terms of cost, environmental impact and sustainability.

GEOFF OGRAM VICE-PRESIDENT, ASSET MANAGEMENT, HYDRO ONE¹⁵
“Transmission Implications of a Low Carbon Supply Mix”

Transmission is often overlooked in discussions of the electricity supply mix. The achievement of greatly reduced reliance on carbon fuels for electricity generation will require new transmission. While it is true that locating new distributed generation close to load (i.e., where the electricity is needed) can reduce or eliminate the need for transmission system upgrades, this only applies to generation that is flexible in regard to siting, such as gas-fired cogeneration or solar panels. When one considers the development of new low carbon and/or renewable options such as hydroelectric, wind and nuclear, these are often of necessity located far from the centres of population where most of the electricity generated will be used. These facilities cannot be developed without ensuring adequate transmission capability. Resources such as wind also vary in time and geography, thereby requiring sufficient flexibility in the supply mix and the grid configuration in order to meet the demand for electricity at any given time.

In Ontario, recent examples of new transmission which help meet such needs include the Parkway Transmission Station which was necessary to enable the shut down of the coal-fired Lakeview Generating Station west of Toronto. Also, the recently announced 1250 MW synchronous interconnection with Quebec, which will allow improved access to hydroelectric power, as well as the banking of off-peak power from Ontario in Hydro Quebec’s storage reservoirs.

Looking forward, Hydro One’s analysis shows that the construction of future generation options, such as nuclear and wind, will require augmentation of Ontario’s transmission system in order to have the capacity to deliver this power to where it is needed. Such plans will represent a key element of the Ontario Integrated Power System Plan being developed by the Ontario Power Authority. Accordingly, Hydro One has developed transmission options as input to this process.

“The last time we did a major new 500 kV transmission line in the province, it took 14 years to get approvals and build it.”

Geoff Ogram
HYDRO ONE

¹⁵Hydro One owns and operates 97% of the transmission within Ontario. Their transmission system carries electricity from generating stations to local distribution companies and large industrial customers through a high-voltage network of transformer stations, transmission towers and wires. (www.hydroonenetworks.com/en/about/)





Four policy considerations were highlighted:

- Identify, approve and construct needed transmission as early as possible, given the amount of new generation that must come on line within the Province of Ontario within the next 5 to 20 years to accommodate the retirement of coal-fired and end-of-life generation facilities.
- Streamline regulatory approvals processes to ensure that transmission is available when needed. Transmission infrastructure has long lead times.
- Adopt policy objectives ensuring that transmission is built in anticipation of generation, as has been done in other jurisdictions.
- Mandate the Ontario Power Authority to prioritize the large number of small, renewable projects so that Hydro One can focus on what appears to be the most economically viable.

“When one looks at the situation, one should not only look at the situation within Ontario, but at interconnections with neighbouring jurisdictions.”

Geoff Ogram
HYDRO ONE

We must get this right. A reliable, cost-competitive, and clean electricity supply is an essential prerequisite for a successful modern economy.

BILL SMITH VICE-PRESIDENT, SIEMENS CANADA
“Building Paths to a Low Carbon Society”

Siemens operates in 192 countries, generating \$120 billion in annual business volume with operations in six business areas, including, Information and Communications, Automation and Control, Power, Transportation, Medical and Lighting. The private sector is often criticized for not investing in technology. However, Siemens, as the largest private-sector R&D firm in the world, invests over seven to eight billion dollars annually.

Based on its international activities, Siemens is well aware that Canada is criticized internationally for its lack of investment in R&D, and for an energy-rich country this is viewed to be a great loss of an opportunity. Canada is the seventh or eighth biggest market place in Siemens view, but only ranks 22nd or 23rd, when one takes into account technological innovation in the energy sector (measured in investment terms). Technological investment is improving in Canada, but there is still a long way to go.

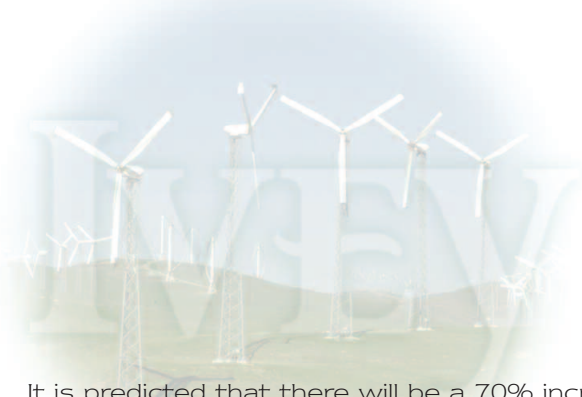
Global megatrends are examined through Siemens’ market research in its countries of operation and prospective countries of investment. Urbanization, resource scarcity and environmental focus are global challenges, not just faced by Canada or Ontario. Every country where Siemens conducts operations faces the same challenges to varying degrees.

Most Canadians are electricity consumers, but how many make the connection between their actions and the source of their electricity? Access to electricity, water and gas is at most Canadian’s fingertips, on demand all-day and everyday. In Gabon, Siemens just completed a project where a village was electrified installing a 250-watt solar panel, so the children could have a light bulb to do their studies in the evening. These are the extremes in energy supply that Siemens experiences in its operational environment.

“Do you make the connection when you go home...and turn on the dishwasher, throw the clothes in the dryer, turn on the oven full blast, that you are contributing to...Nanticoke in the case of Ontario or Keephills in Alberta...”

Bill Smith
SIEMENS





It is predicted that there will be a 70% increase in worldwide power consumption by 2020. As the population grows, people are expecting the same standard of living as those in developed countries. This trend represents significant market opportunities for technology companies. However, meeting the needs of the growing demand for energy should be done consciously and ethically. Oil and gas producers need to minimize and limit the negative impacts of their technologies.

“The big guys are as much a part of the solution, as they are a part of the problem.”

Bill Smith
SIEMENS

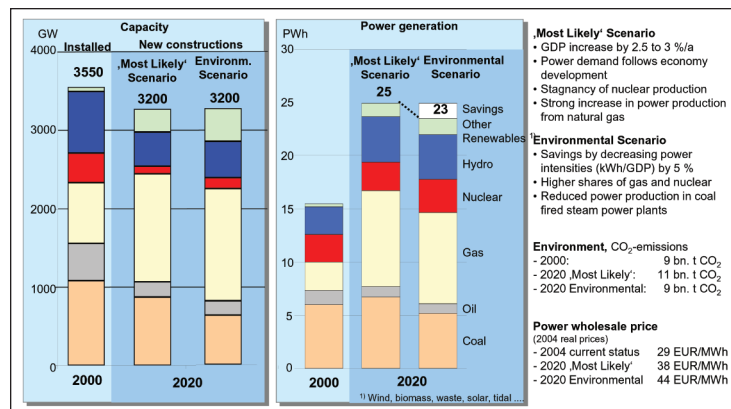
When considering our options for reducing emissions, particularly CO₂, responsibility must be given to all stakeholders. In the case of consumers and industry, reducing emissions can be achieved by discontinuing processes that emit CO₂ through conservation and improving the efficiency of energy systems. The power plant industry can take action with a focus on improving the efficiency of power plants, changing to energy carriers that produce less CO₂ (e.g., natural gas vs. coal), utilizing renewable energy carriers which are CO₂ free and implementing “end of pipe” technology (e.g., carbon capture and sequestration).

A well-balanced energy mix needs to be pursued to address reliability of supply and environmental issues. As we look into the future at primary sources of power generation to 2020, there will be supply mix trends despite the variety of scenarios that could occur (Figure 3). In order to meet the global growth in energy demand, carbon-based fuels will maintain a dominant position in the global market place. Hydro, renewables (primarily wind) and

conservation will play an increasingly important role, as well as a nuclear renaissance being likely. In the long term, we can expect a scenario where renewables grow to over five times the size of their current contribution to the supply mix. Ontario and Quebec have developed large wind projects despite regulatory differences and local content rules in Quebec. Consideration needs to be given to whether current policies and regulations are really encouraging investment in wind and other renewable resources.

The cost of greenhouse gas emissions, primarily CO₂, needs to be emphasized going forward. The environmental and social impacts of fossil power must be included in the overall evaluation of the cost of electricity, either through taxation or opening of carbon trading markets. These market forces combined with effective regulation will drive the value of carbon and place renewables and other forms of energy production on a more equal footing.

FIGURE 3

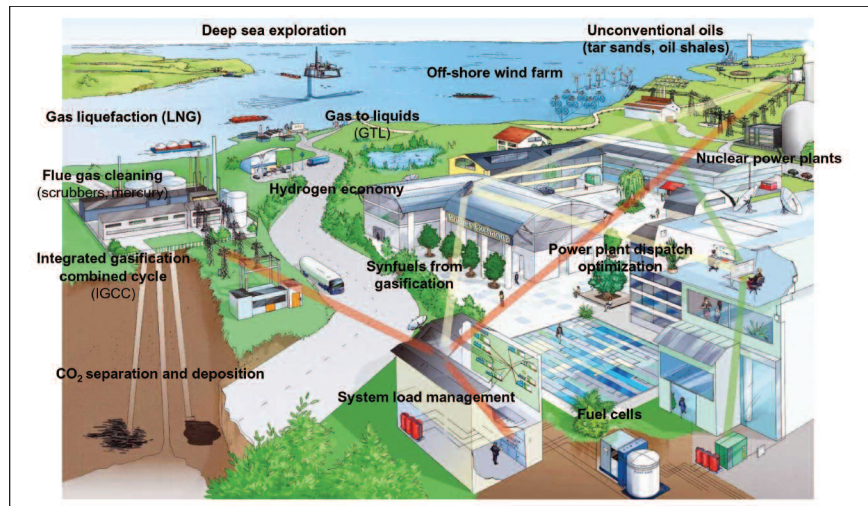


An issue of consideration, perhaps a barrier to delivering a well balanced energy mix, is the siloed structure of the energy sector in Ontario. Problems arise with generation, transmission and distribution operating as largely separate entities. The current structure is multileveled, untimely and expensive, and the organizations are utilizing the scarce human resources required in the field.¹⁶

The focus, moving forward, needs to be about bringing the technologies together to deliver efficiently the electricity that people require. Our future energy landscape should be founded with a set of integrated energy solutions (Figure 4). Integrated information management underpins our ability to set specific goals,

however the energy industry is information rich and seems to be knowledge poor. The vast quantity of information needs to be utilized to make informed decisions about the future of our energy supply.

FIGURE 4



EMERGING POLICY IMPLICATIONS:

- Encourage innovation among hydrocarbon producers to stimulate efficient use as a necessary step towards a sustainable energy economy.
 - *Assess the potential for deploying clean-coal technologies. With the right investment, many existing facilities can perform more efficiently.*
 - *Use life cycle methodology when evaluating renewables. For example, when examining the impact of solar as an energy source, one must take into account the high production cost (environmental impact) of producing silicon or when considering wind, one must take into account the transport costs associated with the construction of the windmills.*
 - *Include the environmental and social impacts of fossil power in the overall evaluation of the cost of electricity, either through taxation or opening of carbon trading markets.*
- Attract more private sector R&D investment in energy technology in Canada.
- Educate consumers to utilize energy rationally and to conserve. Canadians take energy supply for granted, resulting in a limited response to either long-term threats or real-time price signals. Consumer behaviour based upon an attitude of entitlement is not sustainable.

¹⁶Recognizing the fundamental importance of efficient regulation, the OEA launched the OEA/OEB Working Dialogue on Regulatory Efficiency and Effectiveness, thus responding to the need to streamline and improve Ontario's regulatory framework. (www.energyontario.ca/docs/Howard-Aug14.pdf)





- Encourage industry to apply market opportunities with a conscience and an ethical approach to business. Producer behaviour based on either an obligation to serve or driven purely by commodity pricing is not sustainable.
- Consider east-west delivery when evaluating hydro and complementary wind development. This approach will optimize our resources- when the wind blows, fill the dam; when the winds stops, let the water flow.

GLEN MURRAY CHAIR, NATIONAL ROUND TABLE ON ENERGY AND THE ENVIRONMENT
“Advice on a Long-term Strategy on Energy and Climate Change”

The National Roundtable on Energy and the Environment (NRTEE) consists of a secretariat and a plenary group of twenty-four individuals who develop policy options for federal, provincial and municipal governments in this country. Their emphasis is on providing public policy advice to the public sector and increasingly to the private sector. In recent years, they have been focusing their research and attention on determining strategic approaches for dealing with climate change. NRTEE is dedicated to exploring new opportunities to integrate environmental conservation and economic development, in order to sustain Canada’s prosperity and secure its future. Appointed by Governor in Council, its members are distinguished leaders in business and labour, universities, environmental organizations, Aboriginal communities, and municipalities.

Canada has an urgent need to consider climate change and energy issues, as we are the only major signatory and ratifier of Kyoto that is both a major energy user and exporter. **How do you protect your national interest as an energy exporter in the context of international agreements and global policies?**

NRTEE has developed a working definition of our national interest as anything that would negatively impact the sustainability of our economy, our culture and our ecology, in order to create a start point for a truly national discussion, as the specific local (i.e. provincial and or regional) interests/concerns were not always applicable in all other regions/provinces.

In the analysis of their question, where are we on this as a nation and where ought we be? Canada is arguably the one country, of all those industrial and post-industrial, which is most negatively impacted by the effects of climate change. The NRTEE team was able to conclude that with our country’s geography and particular resource space, we are one of the most threatened countries in our sustainability and ecology. Their analysis places Canada in the danger zone for a number of the irreversible effects of climate change, noting that we will be forced to make many changes as an arctic country in the future.

“We would argue that a Canada that meets the greenhouse gas emission challenge is a much more healthy and productive economy, with smarter technology, stronger exports, better energy use and that moves into being a global leader in the world... we’d have an efficiency and productivity advantage that comes along with energy efficiency.”

Glen Murray
 CHAIR, NRTEE





To figure out where we ought to be in the future, NRTEE worked with consultants and experts to develop a model for change that spans over the next 45 years. The scenario that was developed examined one way that Canada can reduce energy related greenhouse gas (GHG)

emissions by 60 percent by 2050 (Figure 5). The model is based upon some key assumptions: the doubling of our population in that time frame, that our economic growth will outstrip our population growth, and that our energy production and exports will grow faster than our economy itself.

Although reductions of this magnitude provide significant challenges, the necessary technologies have the potential to result in significant opportunities for the Canadian economy and its environment. The most important finding from NRTEE's analysis is that these reductions can be made, at least from a technological standpoint.

The model was also based on the principle that all areas of the economy share some interactivity - that is, NRTEE did not treat each area of focus or "wedge" for GHG reduction (i.e. transportation, wind generation, electricity production, CO₂ generation and sequestration) as silos, but rather as areas that interact and impact upon each other. This model is thus different from the American model we see in the film, "An Inconvenient Truth" or in Richard Attenborough's recent TV documentary.

NRTEE looked at interactivity between the wedges in great detail, and unlike other countries, they avoided developing even wedges of reduction in GHG emissions, rather, they looked into what were the most "realistic and doable" possibilities for GHG reductions in the Canadian economy and across regions in Canada.

The key priority areas are also the biggest challenges. They include a number of sub-groups, but are identified as: Energy Efficiency Improvements; Carbon Capture and Sequestration in Oil and Gas; Electricity Generation and Other (Figure 6). One area of great potential that stimulated discussion was for freight transport (part of "Other"). Trucking companies want to do the most that they can to reduce energy consumption.

NRTEE feels that the model they have developed is particularly useful and can be employed by governments to assist in the process of change. Challenges are faced by a multi-level governance system whereby the energy and foreign policy decision-makers are not engaged at the same level or in the same areas of interest. Both have an impact on each other, especially around the Kyoto Accord and other aspects of Canada's energy production and consumption.

FIGURE 5

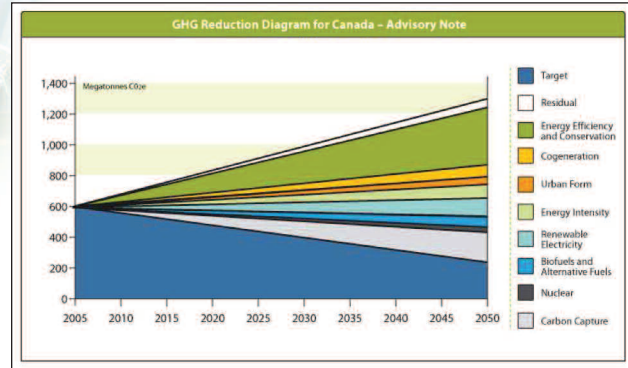
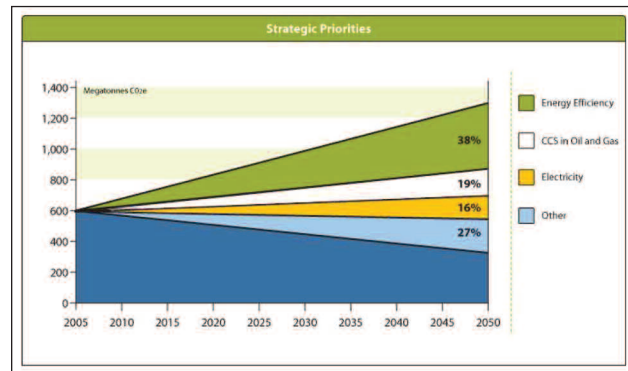


FIGURE 6



SUMMARY OF KEY NRTEE FINDINGS:

- There can be a domestic solution to making significant GHG reductions by mid-century, but significant reductions can be achieved only if energy is used more efficiently and if energy is produced while emitting less carbon. The question should not be focused around which technologies Canada must deploy, but how Canada can deploy all of the potential GHG reduction technologies.
 - *Increasing energy efficiency is crucial. It is possible to achieve approximately 40 percent of our goal of a 60 per cent reduction in GHG emissions.*
 - *Canada can maintain its position as a major energy exporter, but only if carbon capture and sequestration is deployed.*
- Send a long-term signal to help the private sector make short-term investment decisions that take GHG reductions into consideration.
- Recognize that air pollution reductions and other co-benefits will occur along with the reduction of GHG emission reduction in key areas. Significant economic co-benefits through the marketing of clean energy technologies also exist.
- Encourage academics to engage in this discussion and to bring their research to bear in the policy discussions with governments at all levels.

SUMMARY OF DISCUSSION AND SELECTED QUOTES

The discussion following the presentation covered a number of areas, focusing as much on reductions of GHG emissions as it did on the potential energy supply mix for Ontario. What it did raise are a number of the barriers to creating a new energy supply mix, and as well, ways in which the demand for energy supply can be better managed. Questions and responses from the discussion included:

))) Existing Canadian technology for massive GHG reductions

"The City of Toronto just bought a landfill near London for \$210 million dollars, when we have Canadian technology that turns biomass into all kinds of things, like ethanol... we are not embracing even the most conservative estimates of what our technology is currently capable of... especially for major public sector infrastructure, transportation and waste minimization... So I am hoping that industry... becomes much more aggressive in demanding that our Mayors, Premiers and Prime Minister look to Canadian solutions that are more creative than simply buying a large landfill outside the city."

Glen Murray NRTEE

))) Implementing low carbon technology options

"A study on sequestration and gasification technology... ranges of estimates that 20% more is needed in terms of capital for that particular technology. Put a value on carbon of about \$30 a ton and it started to cross the line. We started to build into our planning horizon a value on carbon as we decide where to direct our R&D dollars. We are making the assumption that the markets are going to start to put a value on carbon."

Bill Smith SIEMENS





))) **Relative effectiveness of public policy versus market forces in driving consumer behaviour**

"We did some work on rebates... [such as] a fee for fuel inefficient vehicles and a rebate for vehicles that are more efficient. It just really didn't work. People would drive second hand cars for a longer time; leading to an increase in CO2... standards should be set well in advance. Let auto makers know 5, 10, 15 years before they are expected to meet the challenge that ALL vehicles in Canada have to meet certain standards, rather than through retrofit or replacement. It is a comprehensive solution..."

Glen Murray NRTEE

))) **A comparison of voluntary agreements to legislation**

"We were a supporter of the voluntary agreement with Canadian vehicle manufacturers, with the condition that they table the plan by the end of this year on how they will meet those [emission reduction] goals. I would be very surprised if they have a plan ready by the end of this year. I think there was a tremendous privilege extended to have a voluntary agreement rather than legislation, and the consequences of them not meeting that goal by having a plan will make it very hard in the future to have other voluntary performance based-agreements. Performance-based solutions for different industry sectors where they, with an interactive model, define what they can accomplish will be increasingly important to actually getting the gains we need in time."

Glen Murray NRTEE

))) **The culture of consumerism**

"One of the things that I find worrisome is the excessively optimistic potential that is ascribed to energy efficiency in the long-term. This doesn't take into account that you have to go beyond energy intensity and consider energy service intensity. For example, a whole array of technologies that we're all using in this room didn't exist fifteen years ago. From the overhead projector to the personal digital assistants (PDAs) and cell phones, all of these things tend to offset a lot of the gains that are made in efficiencies."

Ned Djilali UNIVERSITY OF VICTORIA

))) **Tax shifting**

"...When you actually look at... the level of our consumption taxes, our capital gains taxes, our taxes on research, our taxes on property improvement, we have a very hostile tax environment in this country to do most of the things we're advocating to do... We tax everything to death that we suggest is a good thing for human beings to do, and we subsidize most of the things that we say are environmentally bad... I really believe that the only way this is actually ever going to happen is if environmental groups, industry associations and academics actually get together and start bringing ideas into the public square on this. It is not well researched... But I don't think we can achieve these goals without some serious changes to the tax structure."

Glen Murray NRTEE





))) Barriers to distributed energy

"There is a cultural bias against distributed tri-generation. This is a technology that can meet this province's current electricity generation shortages, provide heat, and also meet the rapidly growing demand for air conditioning in the summer. I do not know of any jurisdiction, in the U.S. or Canada, that has the kind of progressive support for distributed co-generation that you can find in the Netherlands, Denmark or the UK... Distributed co-generation dominates other alternatives. It delivers over 80% of the energy in fuels as useful energy services to end-users, while central fossil generation at best delivers 35%. It reduces the probability of being without power by two to three orders of magnitude. And it costs LESS. There is absolutely no answer to why we have not moved to a largely distributed co-generation system, except for the institutional memory of our engineers, utility executives and regulators being fixated on large power plants and endless rows of transmission towers across our landscape."

Hadi Dowlatabadi UNIVERSITY OF BRITISH COLUMBIA

"When we asked the Ontario Energy Board and the Ontario Power Authority to look at the Standard Offer approach for renewable, we also asked them for clean, which means co-gen, tri-gen. The OPA announced the results of the combined heat and power; they would move forward on the Standard Offer for clean energy, beyond renewables."

Marion Fraser ONTARIO MINISTRY OF ENERGY

))) The Standard Offer's ability to relieve transmission constraints¹⁷

"It may offset the need to build some transmission. The question is to what degree will that happen? I think that is one of the questions that the Ontario Power Authority has to address in its integrated system plan..."

Geoff Ogram HYDRO ONE

))) Challenges to transmission planning

"You don't want to build transmission that isn't necessary but you also want to have it built when you need it. It makes it very difficult to define a clear need for a particular facility. Before the creation of the OPA, there was no clear authority for deciding on a need for a given facility in the province. The market construct was one that assumed, in a way, that new transmission would be built on a merchant basis. This is a model that really hasn't worked well anywhere in the world. Having personally participated in trying to get a line built, no one will put out long-term money without assurance of recovery (and return) of their investment. A regulated network has to be centrally planned and scrutinized by a competent regulator."¹⁸

Geoff Ogram HYDRO ONE

¹⁷A large part of the area near the Bruce nuclear power plants has been designated as an "Orange" area and excluded from the Standard Offer Program pending the development of new transmission. This area is one of the prime wind areas in the province. This highlights the need for more proactive planning of transmission and the need for more integrated planning (in communication with London Hydro).

¹⁸Pamela Nowina noted the value of clarity in Ontario as to the responsibilities for planning and development and indicated the IESO, OPA and OEB were working together toward this goal.





))) Fuel Switching - Integrated Management

"Nowhere that I am aware of has regulation at the level of energy services. It is true that gas utilities and electricity utilities each have their own integrated management plans. But we only regulate energy as a commodity and we have failed to regulate energy services. In the U.S. for example, the gas industry and the electricity industry compete for electric water heating, even when the electricity is from coal. Heating up water with natural gas generates one sixth as much CO₂ as doing it with coal based electricity. It should be illegal to offer electric water heating in those jurisdictions when gas is available. No Public Utility Commission (PUC) that I know of is integrating energy service delivery to the consumer and using costs and environmental impacts to define which energy form is appropriate for delivering which service. That is not going on; why can't Ontario be the first to do it?"

Hadi Dowlatabadi UNIVERSITY OF BRITISH COLUMBIA

))) Leaving a legacy for our children

"... Let's stop betting on Kyoto, let's stop acting like this is a football game and who is going to win. Let's actually get off our butts personally and collectively and start doing something about it... If you look at where our parents and grand-parents came from, most of us in this generation understand how privileged we are; I think fundamentally there is a sense of legacy and citizenship here that we each have to own. I can't think of anything more important you can do with your life than taking on this challenge right now, and leaving our legacy to our kids of actually having tackled this problem and having handed them something better than a collapsing environment, which is the alternative of not doing it. I am optimistic because we have so much more capacity in this generation to take on this challenge and I'm so frustrated sometimes when I hear all the excuses for not acting."

Glen Murray NRTEE



Session Three

Hydrogen, Hybrids and Husks: Fuels for the Future

Kevin Fitzgibbons EXECUTIVE DIRECTOR
OFFICE OF THE NATIONAL SCIENCE ADVISOR, GOVERNMENT OF CANADA

CONTEXT

Over the course of the past century, technological innovations have had a profound effect on virtually every aspect of our lives, ranging from the discovery of new vaccines to protect us against diphtheria and polio to the invention of the internet. In the world of transportation, the combined commercial introduction of the internal combustion engine, the refining of gasoline and the mass production of automobiles in the early 20th century has fundamentally altered our lifestyles, our use of the energy system, and the drivers of our economy. Most of those transformative innovations were first invented in the mid-19th century and took decades to work into the economy.

What is the next generation of transformative technologies that will reduce our dependence on carbon-based fuels in the coming decades? What are the challenges facing companies and policy makers in ensuring that the most promising and environmentally benign technologies are successfully introduced into the market?

OBJECTIVES AND FOCUS

The purpose of the third panel discussion was to present the science and technology issues and policy implications for the development and market introduction of newly emerging low carbon fuel technologies for Canada. The panel format was structured around three core questions for discussion:

1. *What are the most promising technological options for providing a low carbon fuel mix in the coming decade? Why?*
2. *What are the most important technical, economic and social issues associated with their development and adoption?*
3. *What are the policy implications and decisions that need to be made (federally, provincially, locally) to ensure that they are successfully adopted?*

Pierre Rivard EXECUTIVE CHAIR OF THE BOARD, HYDROGENICS
“Policy Enablement of Hydrogen and Fuel Cells Solutions to Climate Change”

The mission of Hydrogenics is to change the way the world looks at using energy and power through the development of clean hydrogen and fuel cell technology. The company will achieve this mission through the application of innovation and strategic partnerships.



Hydrogen provides energy benefits to Canadians through ensuring energy security; improving urban air quality and reducing green house gas emissions; providing energy storage and power generating efficiencies; and greater design flexibilities with electricity. However, the long-term prospects for hydrogen are competing against incumbent technologies and if national policy objectives such as clean air, GHG reductions, economic growth and energy security are to be addressed, a more strategic policy perspective needs to be developed.

Canada's fuel cell and hydrogen industry is a world leader with over \$1 billion in private sector R&D investments over the past four years - representing almost 1/3 of all private sector energy R&D. In addition, the Canadian government has committed \$215 million in funding of which 50% has been allocated. As a result, Canadian firms are industry leaders in early stage commercialization in applications such as backup power, materials handling, transit buses and micro power.



The current government's short-sighted philosophy of "let the markets decide" is severely handicapping the progress of the Canadian hydrogen and fuel cell industry in the face of aggressive investments in other countries such as the U.S., Japan, Korea, China and Europe. As such, there are three core policy challenges for governments:

- Achieve cost and performance targets through program and tax incentives to increase private sector R&D investment, such as improved access to research and development tax credits and investment mechanisms that help companies more effectively manage technological risk;
- Stimulate demand in the face of existing technologies by levelling the playing field for more sustainable energy technologies; lowering investment risks for early adopters;
- Enable the creation of designated districts for fast track adoption of new energy technologies such as the Hydrogen Village in Toronto¹⁹; and
- Create Canadian successes on the world stage by facilitating international agreements and collaborations to advance high-volume manufacturing, commercialization and market access such as with the U.S. FreedomCar Initiative²⁰.

¹⁹For more information about the Hydrogen Village in Toronto visit: <http://www.hydrogenvillage.ca/> .

²⁰For more information on the U.S. FreedomCar Initiative visit:
http://www1.eere.energy.gov/hydrogenandfuelcells/presidents_initiative.html or
<http://www1.eere.energy.gov/vehiclesandfuels/> .





Maurice Hladik, DIRECTOR OF MARKETING, IOGEN CORPORATION
“Cellulose Ethanol is Ready to Go”

Iogen plays a world leading role in the development of cellulose-based enzyme technology for making ethanol from biomass. Iogen designed, owns and operates the world’s first and largest cellulose ethanol demonstration facility and has entered into partnerships with Shell, Petro-Canada, Goldman Sachs, and the Government of Canada to move the technology beyond demonstration to full commercialization.

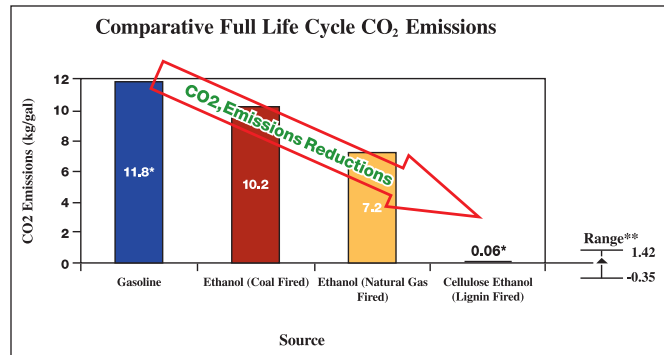
Lignin-fired cellulose ethanol is a highly promising low carbon fuel technology, primarily because of its considerable advantage in producing lower CO₂ emissions over the full life cycle of production and use in comparison with gasoline, and coal and gas-fired ethanol.

In addition, cellulose ethanol is beneficial from an agricultural policy perspective because it uses agricultural waste, residue, and lower value crops such as switch grass and other biomass sources more cost effectively in northern climates than traditional ethanol feedstock such as corn.

The key policy and commercial rollout issues revolve around five key criteria:

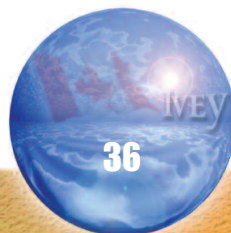
- Access to high quality, low cost biomass feedstock;
- Tax and financial incentives;
- Availability and cost of supporting infrastructure such as water, gas, transportation and electrical power;
- Investment climate for industrial development and financing options; and
- Access to clients, refineries and off-take customers.

Iogen is currently taking a global perspective in seeking out the most promising investment and production options based on these criteria. Government policies supporting the introduction of new, low carbon alternatives to petroleum-based fuel consumption around the world provide considerable opportunities for Iogen and other biomass fuel developers.



“The U.S. is projecting that by 2025, cellulosic ethanol will account for about 25% of the gasoline requirements in a growing market. Given that the United States consumes about 50% of the world’s gasoline, that’s a big play.”

Maurice Hladik
IOGEN CORP.





Brian Swift, Director ENVIRONMENTAL AFFAIRS, GM CANADA
“GM Advanced Propulsion Strategies”

As an integrator and major adopter of new technologies for the automobile industry, GM Canada is well placed to provide an Original Equipment Manufacturer’s perspective on the prospects for new fuel technologies in the consumer market. For example, GM Canada has recently entered into demonstration partnerships with both Hydrogenics and Iogen.

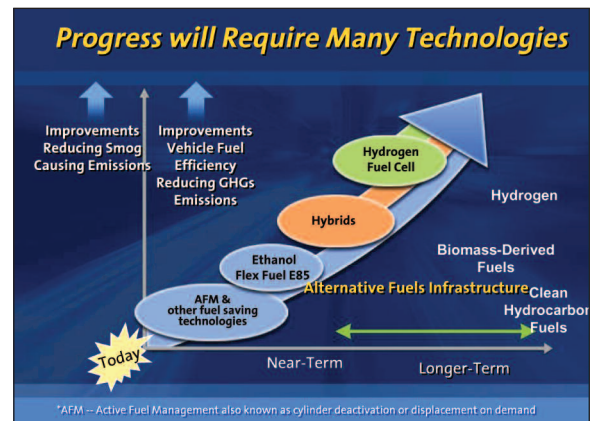
The support for and adoption of these and other emerging low carbon fuel technologies contributes to GM’s long-term vision of removing the automobile from environmental and energy debates.

From the perspective of GM, the future solution to improved vehicle efficiency and reduced emissions will require many technologies, ranging from active fuel management (AFM) technologies in the short term to hydrogen fuel cell technologies in the more distant future.

GM’s past achievements of new emissions technologies date back to the introduction of catalytic converters in the mid-1970s. Today, all on-road and light duty trucks represent only 9.5% of smog forming emissions and 12.5% of GHG emissions from all sectors. New vehicle fuel efficiency and emission reduction performance are orders of magnitude better than cars of only a decade ago.

The GM near-term technology plan includes the continued expansion of GM E85 vehicles already on the road; and commercializing variable valve timing and six-speed transmission technologies. GM’s introduction of more than two million AFM-equipped vehicles by 2008 in Canada alone will save more gasoline and therefore provide more GHG reduction benefit on an annual basis than all hybrids sold in Canada. Current challenges include federal and provincial commitments to a renewable fuels strategy and a need to improve the E85 refuelling infrastructure in Canada through support to producers, fuel taxes, vehicle technology adoption support programs, and mandates similar to policies being pursued in the U.S., Sweden and Brazil.


GM’s medium-term hybrid strategy will focus on developing a broad portfolio of products targeting the highest fuel consuming vehicles first with the development of three distinct hybrid propulsion systems while ensuring vehicle performance at competitive levels.



“In reducing smog causing and greenhouse gas emissions, new technology is important but requires an integrated approach. Cleaner fuels, formulations, consumer behaviour, fleet turnover, vehicle kilometre traveled, transportation infrastructure, traffic management, fuel costs all need to be part of the discussion.”

Brian Swift
GM CANADA





GM's hydrogen powered fuel cell vehicle strategy is tied to the company's recently announced commitment to building the world's largest fuel cell fleet. To deliver on that strategy, GM Canada's engineering centre in Oshawa has entered into alliances with technology leaders, such as Hydrogenics, to further develop the technology so that it can be a viable alternative to gasoline-powered internal combustion engines in the coming decades.

Graham Campbell DIRECTOR GENERAL, OFFICE OF ENERGY RESEARCH AND DEVELOPMENT
NATURAL RESOURCES CANADA (NRCAN)

“Transportation Technology Considerations to Guide Federal Energy R&D: Are we moving towards more electrification in addition to hydrogen, hybrids and husks?”

The transportation sector is the single largest (26%) source of GHG emissions in Canada, with rapidly-growing demand, local environmental impacts, and rapid technology turnover. In Canada, the transportation sector is a particular challenge because of its higher number of point sources than is the case for fossil fuel supply or industrial end-use. Within the transportation envelope, the largest source of GHGs comes from the gasoline automobile (27%) and light duty gasoline truck (23%) segments.

NRCAN's current transportation energy research portfolio is broad - covering biofuels, emissions, particulates, hydrogen and fuel cells, and advanced lightweight materials. That being said, close to half of NRCAN's R&D investments are concentrated in hydrogen and fuel cell technologies.

Well-to-Wheel²¹ analyses for two other emerging technologies, Plug-in Hybrids and Pure Electric Vehicles are positive, provided that the charging current comes from low-emission sources. Nevertheless, outside of a limited number of niche applications, the technologies are not yet ready for market entry. For example, R&D to address battery costs, weight and capacity issues warrant new investment.

Taken together, this emerging suite of new technologies offers a far more diversified mix of fuels and technology platforms for the automotive sector in the coming years.

Faced with this opportunity, the challenge for Canada is to bring technology solutions to a state of readiness, through development and pre-commercialization work and participation in multilateral (e.g., International Energy Agency) and bilateral (e.g., U.S. Department of Energy) projects on a portfolio of emerging technologies matched to prospects in domestic and foreign markets.

There is no single, silver bullet solution to the low carbon energy future but rather a complex and competitive portfolio of promising options for which both governments and industry will need to continue to pursue in partnership and with an open mind to new opportunities.

“While we need to focus, we also need to keep our options open and keep an open mind as to new opportunities as they come along. Clearly transportation is one of our biggest challenges and solutions are needed if we have any hope of achieving the sustainable development and responsible end-use of energy.”

Graham Campbell
NATURAL RESOURCES
CANADA

²¹Well-to-Wheel analysis is a systems approach to assessing the energy consumption and greenhouse gas emissions associated with different fuels and vehicle propulsion systems. A well-to-wheel analysis takes into account energy use and emissions at every stage of the process, from the moment the fuel is produced at the “well” to the moment the “wheels” are moved. (www.energyindependencenow.org/pdf/fs/EIN-Well-to-Wheel-Analysis.pdf)





Discussion and Selected Quotes

The discussion following the presentations focused on a number of issues including:

))) **A broader use of other sources of biomass such as food waste**

"An inedible kilogram of food by-product can equal almost 10 kilograms of CO₂ through methane degradation. This is great energy opportunity as well as a great CO₂ abatement and odour control strategy, where we can get it."

Phil Dick ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

))) **The ability to leapfrog into new technologies by working in emerging markets**

"The city of Shanghai has announced a two hundred million dollar project to deploy fuel cell vehicles: first 100 by the 2008 summer Olympics, 1,000 by the 2010 World Expo and then 10,000 by 2012. The city plans to use hydrogen gas recovered from local steel plants to power fuel cell taxis and buses. China could become a world leader in the electrification of transportation systems."

John Tak HYDROGEN & FUEL CELLS CANADA

))) **The viability of looking at a broader mix of domestic energy sources as a substitute for oil**

"The future will show that there are tremendous benefits to generate, through all these different ways, fuels from indigenous resources that will have significant positive impact on Canada's balance of trade, the creation of high-value employment and technology export ready knowledge-based businesses within our own country. Many countries have historically produced the bulk of their electricity through the use of indigenous energy sources. Producing in a sustainable manner fuels such as hydrogen, biodiesel, ethanol and others from indigenous energy sources will have a significant impact on world peace, global trade and prosperity."

Andrew Stuart SUSTAINABILITY SHIFT INC.

))) **The need to look at the potential for biomass as a thermal energy source**

"In Canada, because we are located in the northern part of the North American continent, thermal energy is a huge energy factor. Our thermal energy loads across the country, whether it's processing or space heating is significant, and converting biomass can be an awfully good step in the direction of sustainable, renewable energy."

Michael Rich RENEWABLE ENERGY GENERATION INC.

))) **Considerations in making the shift from a petroleum-based to renewable energy resources**

"The distribution of hydrogen or bio-fuels, particularly within the developing economies, is a critical barrier to moving more aggressively. So the example that we heard about here with China-where they don't have to undo a lot of infrastructure-may in fact, offer a bigger step forward, at least in the short-term. But are we, in North America, taking active steps to supplement or even displace some of the distribution that is out there that is largely petroleum based?"

Rob Klassen RICHARD IVEY SCHOOL OF BUSINESS





))) **The competitive nature of existing technologies in the face of challenges from emerging options**

“These are all great technologies and great ideas, [but] we need to look at them not in terms of where we are now but in terms of where the world is apt to be in 10, 15 or 20 years, when the demand side will have undergone another transformation... there needs to be some place where there is a matrix of integrated advice and analysis that’s going on or we could end up going off in all sorts of wrong directions.”

Ralph Torrie ICF CONSULTING

))) **The need to take the longer term strategic view in energy and environmental technologies**

“You have to look at it over a longer time period. There have been some shifts occurring in energy systems over the past 500 years. We may not know it yet, but we may be in the midst of a shift that is occurring as we speak... Obviously it is hard to predict where we are going to go, but lets hedge our bets and get a portfolio of possibilities as a nation and policies to permit us to capture all of these opportunities when they emerge.”

Pierre Rivard HYDROGENICS



Session Four

Creating a Culture of Conservation: Managing Energy Demand

Ken Ogilvie EXECUTIVE DIRECTOR, POLLUTION PROBE

CONTEXT

As a result of our rapidly evolving external environment, economic, environmental and social factors are forcing us to rethink our perspective on energy. In the past, we operated in an environment in which energy resources were abundant. As some of these resources are diminishing and the effects of large-scale use are being recognized, we are faced with the challenge of re-evaluating our energy supply mix. There is great potential for demand management and conservation to be a central part of energy policy. Conservation practices are the alternative to investing in new generation and transmission infrastructure to ensure that demand does not exceed supply.

OBJECTIVES AND FOCUS

This session was intended to stimulate discussion and come forward with ideas focused on creating a culture of conservation in various settings (e.g., utility customers, public sector employees and children), as well as policy links and the roles and responsibilities of different levels of government in creating this culture. Each panel participant provided a different perspective on the scope, and implementation, of conservation policies. Panel participants were asked:

How can we better manage energy demand and shift our culture in Canada to one of conservation?

RALPH TORRIE ICF INTERNATIONAL

"History, Hope and the Culture of Conservation"

Historically, the demand for energy commodities (fuels and electricity) was seen as being fundamentally tied to economic growth. As a result, energy policy and commodity supply investment strategies were built on the premise that commodity consumption must grow for economic output to grow. A review of the history of electricity consumption in Ontario illuminates a series of transitions that evidently came as surprises to those who were counting on electricity consumption to continue to grow with economic output (e.g., Ontario Hydro, and most utilities and government energy policy agencies in the 1970's and 1980's).²²

"I still have the report on my shelf from the Department of Energy Mines & Resources in Ottawa, published in 1973, called "A Possible Energy Future for Canada" ... Between 2040 and 2050 to make this "possible energy future" we would have had to bring on a CANDU every five and a half days. That is when guys like me started to question authority..."

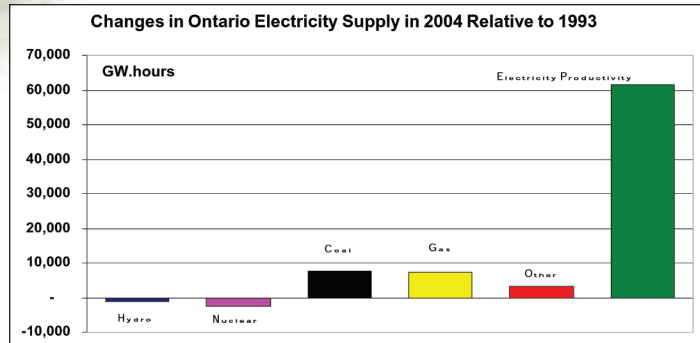
Ralph Torrie
ICF CONSULTING

²²Learn about these transitions in greater detail in Ralph Torrie's paper "History, Hope and the Culture of Conservation in Ontario's Electricity System", posted on the Lawrence National Centre's website: www.ivey.uwo.ca/lawrencecentre/energy/report.htm .





FIGURE 7



In the 1970's and the 1980's, the growth rates of electricity consumption that had formed the basis for capital expansion plans failed to materialize as the relationship between electricity consumption and economic growth reached a new equilibrium. A second major transition took place in the early 1990's, in which electricity productivity of the Ontario economy (measured as

dollars of GPP per kilowatt-hour consumed) began to grow dramatically. Between 1993 and 2003, improvements in electricity productivity emerged as by far the largest source of electricity supply security in Ontario, larger than the increased output of the coal and gas plants combined, and three times larger than the decline in the output of the nuclear plants. This increase in the energy productivity of the economy is the result of both improvements in the energy efficiency of technology and a shift in economic output toward less energy intensive goods and services.

We have arrived at another crossroad in the continuing and dynamic story of electricity in Ontario. If history has taught us anything, it is that changes on the "demand side" of the electricity equation are paramount. We need to pay very close attention to what might happen, what could happen, and what we could make happen with regard to continued improvements in Ontario's electricity productivity.

Unlike the supply side resources, the demand side resource grows every time someone thinks up a new way to deliver services with less, rather than more, electricity. An economy that delivers its energy services with less, rather than more, production and consumption of fuels and electricity is generally a more efficient and competitive economy. Improvements in energy efficiency, and more generally in energy productivity, cannot be matched by any of the supply side alternatives.

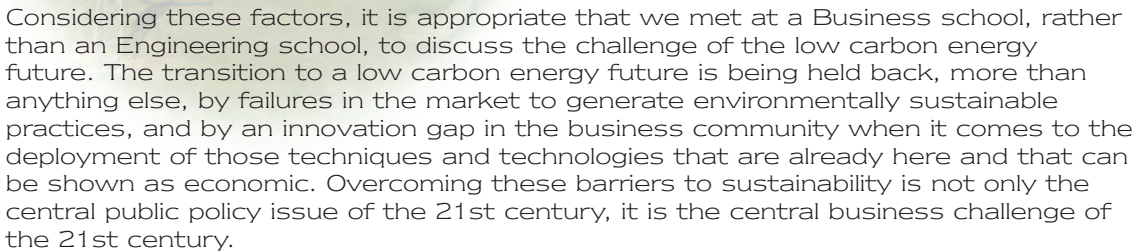
In the specific case of achieving a low carbon society, it is the conclusion of virtually all the research that has been done on what a low emission future might look like, that a *doubling and a redoubling of energy efficiency is a cornerstone feature of such futures*, not only for its direct emission reduction impact, but also for the enabling role that improved efficiency plays in making it possible for the new and renewable supply sources to fill their potentials.

It is not technological or economic feasibility that is preventing us from maximizing our electricity productivity. The barriers that face accelerated deployment of the demand side resource have to do with organization, financing and human resource mobilization.

"It is improvements in energy productivity that have contributed more than all of the commodity supply increases added together since the mid-1970's, and you can do that experiment for every single OECD economy and come to the same conclusion."

Ralph Torrie
ICF CONSULTING





Considering these factors, it is appropriate that we met at a Business school, rather than an Engineering school, to discuss the challenge of the low carbon energy future. The transition to a low carbon energy future is being held back, more than anything else, by failures in the market to generate environmentally sustainable practices, and by an innovation gap in the business community when it comes to the deployment of those techniques and technologies that are already here and that can be shown as economic. Overcoming these barriers to sustainability is not only the central public policy issue of the 21st century, it is the central business challenge of the 21st century.

While there is a demonstrable advantage to having a population that is educated with respect to sustainable energy (e.g., consumer choice, vehicle operation, household operation, etc), the larger and more profound impact will come from the re-education of those who are involved in the design, construction, marketing and deployment of anything that delivers energy services. This includes businesses and entrepreneurs that devise and deliver deployment strategies for new techniques and technologies. It also includes urban planners, investment bankers, architects, lawyers, engineers of all kinds, building developers, industrial process designers, the building trades, and everyone engaged in investment and purchasing decisions for equipment, vehicles and other energy using technologies.

How soon we step up to the challenge would not matter so much if it were not for the advancing environmental damage done by the production and consumption of energy commodities, including fossil fuels. The climate change threat, in particular, has the potential to fundamentally disrupt human society for generations to come if we do not bring our greenhouse gas emissions down well below half their current levels, and relatively soon. While there is and always will be an enormous scope for the research and development of advanced and more efficient ways of providing end use services, it is not a shortage of technological solutions that is holding us back at this point. It is a shortage of imagination, innovation and creative risk-taking in the deployment of these solutions. It is a challenge to governments and to educators, but most importantly it is a challenge to business.

Policy considerations that were highlighted:

- Develop the kind of information databases required to effectively analyze energy demand (explore the size of the Demand/Supply Management “reserve”). The risks of committing resources to long lead power supply projects can only be properly assessed when databases are assembled and the dynamics of the demand for electricity are understood.
- Explore strategies as to how the government can receive timely responses to questions relating to environmental, energy and climate change issues. The challenge is to find researchers and/or practitioners who are qualified to speak as advisors and who set aside vested interests. Universities, colleges and businesses have expertise, but it was observed that response in a required timeframe, and knowledge mobilization, remain as challenges. Different approaches should be explored stressing the need for business, academia and government working together to offer timely solutions.

“...here is this gigantic resource that is developing on its own to a certain extent. What if we were to systematically go after it with the same kind of enthusiasm, energy and determination that we are willing to bring to solar panels, windmills, tar sands and nuclear power plants...”

Ralph Torrie
ICF CONSULTING





- Exploit and capture energy efficiency gains as a way of hedging against the risk of repeating the investment overshoot that has occurred historically. A deliberate and aggressive effort by government and business to scientifically and systematically exploit the demand side resource is the foundation of both economic and scientific sustainability. We know from first hand experience the economic consequences of errant planning, poor strategy and misguided investment in our electricity industry and are just beginning to appreciate the environmental consequences.

Gary Paul VICE-PRESIDENT, CAPGEMINI'S UTILITY PRACTICE
“Smart Meter Concept”

Capgemini, Bell Canada Enterprises Inc. (BCE) and Hewlett Packard (HP) are developing new and complementary technologies to enhance the effectiveness of Smart Meters²³. Collectively, they believe that the introduction of Smart Meters will be a primary driver in changing societal behaviour and developing a culture of conservation by changing the way we go about our daily lives and the way we think about energy and electricity. Successful development and implementation of these technologies will enhance the potential to shape consumption patterns by individual households. Ontario is commended for its tremendous leadership in the area of demand side management. Ontario's pilot programs and technologies are leading edge in a global context.

Residential household consumption typically accounts for 30% of electricity demand in most developed countries. Importantly, residential customers in Ontario usually account for a large share of peak consumption during daily or seasonal periods, reflecting the usage of air conditioning and heating systems. Policies that encourage shifting of residential demand from peak to non-peak periods can have a significant effect on the need to construct peaking power plants, thereby lowering overall system costs. Smart meters, which charge real-time wholesale power prices to households, rather than a fixed hourly rate, may be able to encourage such a shift (i.e., premium pricing for peak usage).


A number of state-wide pilots were conducted in California to evaluate the impact of demand management programs using smart metering technology. Control groups were used to compare consumer behavior when subjected to critical peak pricing (CPP), time-of-use rates around critical peak periods. CPP allows customers who reduce their demand during peak periods to receive significant economic benefits. The pilots in California suggest that when faced with real-time electricity prices, households significantly reduced their consumption of electricity during peak periods, as predicted. Two scenarios were used to study consumer reactions to smart metering technology. One control group was able to redistribute their energy consumption manually, whereas another control group was given automatic tools to reduce their consumption. In the first study, they achieved a 10% reduction in demand during critical peak periods. In the second study, with controls, they achieved a 20% reduction in demand.

“They saw the same economic incentive, whether they had automated or manual control over their energy usage. But they were much more effective at making the change when they had automated support...”

Gary Paul
CAPGEMINI

²³To learn more about the Smart Meter Initiative underway in Ontario visit:
http://www.oeb.gov.on.ca/html/en/industryrelations/ongoingprojects_smartmeters.htm or
<http://www.energy.gov.on.ca/index.cfm?fuseaction=electricity.smartmeters>





The technology has not yet had wide-scale implementation in any country, so further developments are likely to occur. When implemented, Smart Meters will create new value for Ontarians by reducing the need to construct additional generating capacity to meet peak demand, create new commercial models and make Ontario a world leader in product/service technologies.

Load control devices are an alternative solution to demand side management. A study at Florida Power and Light involved placing load control devices on customers' appliances. This device is transparent to the customer and is essentially controlled by the utility. It not only improves or reduces the need for additional capacity, but also improves system reliability.

Emerging Implications:

1. *Encourage industry to introduce this technology with a focus on customers perceiving value in what is being installed sooner rather than later. A significant amount of time and investment is required to replace traditional meters, and cost savings for the customer may not seem to be substantial until they have accumulated over several bills. Also, system benefits such as peak shifting may not seem readily apparent to consumers. Tools, such as home displays, smart thermostats and timers or other energy management devices should be developed to achieve this.*
2. *To maximize effectiveness of energy management technologies, use new tools that are simple, accessible and automatic. Consumers need to be enabled to make choices versus the utility.*
3. *Encourage business collaboration in the development of creative tools and technologies.²⁴ A collaborative effort will facilitate the development of new complementary technologies to enhance the benefits of Smart Meter technology for consumers.*
4. *Ensure that industry supports this process of change by focusing on customer education, including youth, in the area of demand management and energy conservation.*

"They [our youth] are more adaptive and are the "tech support" at home. As in the past, they will respond to technology changes and create appropriate behaviours around conservation."

Gary Paul
CAPGEMINI

Guy Holburn ASSISTANT PROFESSOR, RICHARD IVEY SCHOOL OF BUSINESS
"Two Organizations' Responses to Energy Conservation Policy: London Hospitals and London Hydro"

The results of two case studies of organizations, London Hospitals and London Hydro, which had recently implemented energy conservation programs, were presented. The goal of these studies was to understand the decision-making processes that lead organizations to invest, or not, in projects that lower energy consumption. As such, they represent a snapshot of how certain organizations respond to government environmental policies. London Hospitals and London Hydro both invested significantly in programs that reduced their energy consumption (or in the case of London Hydro, of residential customers). However, in both cases, a variety of constraints prevented other beneficial projects from being implemented.

²⁴Capgemini has also created a "Smart Energy Alliance" with companies such as Cisco, Oracle and Microsoft. For more information on the alliance, visit: http://www.capgemini.com/resources/solution_material/smart_energy_alliance_background/ .





For both organizations, uncertainty about future government policies - including timeframes, funding for environmental projects, approval criteria - led to only those projects with short-term paybacks being funded. Further, capital constraints meant that other profitable projects were not implemented.

Emerging Policy Implications:

- **Government funding time horizons should match energy management program durations.** Many programs require upfront capital and on-going operational and capital investments. Smart metering and integrated remote monitoring and management systems are examples where customers, suppliers and utilities incur costs over a period of time. Government funds that aim to encourage such investments should allow the recovery of costs during the lifetime of energy projects rather than simply the initial capital expenditures.
- **Leverage and reward best practices and innovation.** Technological and energy management practice uncertainties can impede the adoption of energy management programs in both the public and private sectors. Organizations that are focused on developing their core competencies may not appreciate the potential financial benefits of energy management investments or have the managerial resources to investigate them. One way to reduce the uncertainties surrounding this field is for the government to leverage success-stories by publicizing organizational achievements, and to educate commercial and industrial consumers. A mechanism for effective promotion would be to fund industry-focused learning communities in which experienced managers can share their knowledge about energy management across multiple, similar organizations (e.g., the hospitals community).
- **Clarify regulatory processes.** Uncertainty over government funding policies - funding amounts, eligibility criterion, compensation methods, time horizons - discourages investments in energy management programs. This is particularly pronounced for large investments that extend over multiple years. Explicit and specific government commitments to policy goals and administrative mechanisms will reduce the perceived risks associated with government funding.

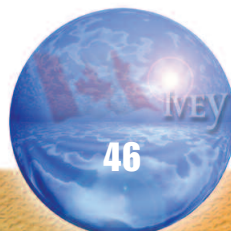
Bonnie Schmidt PH.D., PRESIDENT, LET'S TALK SCIENCE
"Fostering a Culture of Conservation"


Let's Talk Science strives to improve science literacy through leadership, innovative educational programs, research, and advocacy. Educators, scientists and volunteers work together to motivate and empower youth to use science, technology and engineering to develop critical skills, knowledge and attitudes needed to thrive in our world.

The importance of education in developing sustainable energy policy and a low carbon society was a re-occurring theme in the session discussions. Canada must foster a culture of conservation in order to manage energy demand effectively. Shifting cultural views and norms require more than a media-driven awareness campaign. It demands a long-term commitment to educating adults and youth.

"Public opinion - it matters - it can be changed... we have come an awfully long way in the last ten to twenty years [recycling, smoking]."

Bonnie Schmidt
 LET'S TALK
 SCIENCE





Long-term, sustainable changes in public opinion that result in cultural shifts can be made by educating youth. It is often far easier to learn and adopt positive habits of conservation early in life than it is to change long-standing negative habits of consumption. Additionally, by reaching youth, it is also possible to influence adult behaviour. Parents and grandparents not only hear messages brought home by their youth, but they are also more likely to alter their own behaviour patterns to be positive role models.

Youth can be reached in many ways, including through the formal education system. Teachers, in particular, can be effective agents of change, with each teacher reaching 20-30 students each year; that is, approximately 1,000 students each during their career. However, teachers require good curriculum documents that reflect relevant issues to guide their teaching. They also require resources and training in order to meet the goals and expectations that curricula policy demand. As school culture is set by the school leadership, it is essential that principals understand and support the goals. In addition to ensuring that teachers are prepared to teach the fundamentals required for youth to adopt a conservation culture, there is also a tremendous opportunity to bring conservation practices to 'life' in the construction of new school facilities and the retrofitting of existing facilities.

RECOMMENDATIONS:²⁵

- Develop common messages, goals and objectives for Kindergarten - Grade 12 education curricula across Canada:
 - *What does it mean to have a 'conservation culture'?*
 - *What knowledge, attitudes and skills will youth require?*
- Provide teachers with resources and training during teacher education and in classroom.
 - *Align training and teaching resources with curriculum expectations*
- Ensure school leadership reinforces importance of conservation and sets school culture accordingly.
- Ensure construction and retrofitting of school facilities incorporates conservation practices and technologies.

²⁵It was observed that school leadership, education curriculum, teacher training, and apprenticeship training is within the jurisdiction of the provinces and local school boards. There have been, however, times in our country where national priorities have forged provincial collaboration with the federal governments' leadership, providing expert advice and resources. This is one of those times that, with the support of provinces, including academia, business, government and all those involved in the education of our citizens, we need to rise to the challenge. This could result in high quality curriculum implementation, business and industry education and training programs, knowledge mobilization, and timely research across all sectors.





DISCUSSION AND SELECTED QUOTES

The discussion following the presentation focused on a number of issues, including:

))) **Energy productivity “super giants” are barely tapped despite technology and techniques being available**

“It’s going to vary from one energy economy to the next. Freight transportation has a huge potential for efficiency improvement. We are not nearly as far along in improving the energy efficiency of trucks (e.g. courier vans and delivery trucks) as we are with personal vehicles... Another very important one, is to start making sure that we get our new commercial and residential buildings up to a much higher level of efficiency when we build them. It’s so much harder, more expensive and less effective to try and fix them later... every new building... that goes up is contributing to our emissions for decades into the future. A third priority is the potential for improvement in the use of electricity..”

Ralph Torrie ICF INTERNATIONAL

))) **Companies implementing cultures of energy efficiency**

“If you take all energy, not just electricity, for Canada, about 38% of all energy is used by industry. The Canadian Industry Program on Energy Conservation (CIPEC)²⁶ is going to be publishing an annual report that is an example of 50 companies in Canada that have their mind set to energy conservation and have demonstrated outstanding conservation practices.”

Doug Speers IVEY BOARD MEMBER

“Ray Anderson... decided to go green. Much to his embarrassment, it added to his bottom line, it helped him survive a recession. Their [Interface Inc.’s] plant in Bellville, Ontario, one of their greenest facilities, is now making carpets for the US market because the customers are demanding the greenest possible product.”

Ralph Torrie, ICF INTERNATIONAL

))) **An international comparison of initiatives similar to “Let’s Talk Science”**

“If we talk about the bigger issues around science literacy, and the need to support teachers and reach kids, then there are many countries that are much farther ahead of what we are doing in Canada. They are taking a systematic approach to the issue by developing national visions, establishing common goals and objectives and, increasingly, by launching national programs and policies. Canada is really falling behind in that domain. As a country, we’re not even talking about the importance of science and technology education, which is required to ensure that we have the highly trained people needed to work in the sectors that we’re all engaged in.”

Bonnie Schmidt LET’S TALK SCIENCE

))) **The need for more public-private partnerships to fund capital projects**

“So why can’t we think differently in terms of ways of raising capital? This comes back to the fact that it isn’t always about governments, it’s also about the private sector. I think BC and the UK have done a great job in terms of public-private partnerships... projects stall because we lack sufficient capital. There is a fabulous opportunity if we just get a little more progressive in the way we look at funding for some of the big infrastructure projects... We don’t have different institutions working together. If we cooperated on some of these projects, the investment would be more attractive.”

Carol Stephenson RICHARD IVEY SCHOOL OF BUSINESS

²⁶For more information on the voluntary partnership between the Government of Canada and industry to improve Canada’s industrial energy efficiency visit: <http://oee.nrcan.gc.ca/industrial/cipec.cfm> .





"Our federal government, with the Federal Building Initiatives program²⁷ has aimed at reducing energy consumption in all federal facilities across Canada. Specifically, we have a contract that demands that organizations like ours find the funding and, in fact, put all of the debt on our balance sheet and not on the federal government. Those programs are available today and can be implemented on projects as small as a million dollars... Our industry recognizes that energy projects will never be able to compete for available capital against a client's mission-critical activities, in the case of a hospital for example, buying capital intensive equipment like an MRI."

Luis Rodrigues HONEYWELL

"A local community college (Ridgetown) wants to establish an energy focus for training, demonstration and research -based on different complementary renewable energy technologies. I'm very proud that the small organization that I represent is totally technology neutral. We're not a technology vendor, but we are looking for opportunities to underwrite the capital expense of installing operational biomass-based energy systems... It's up to all of us to look beyond the silos to try to bring things together."

Michael Rich RENEWABLE ENERGY GENERATION INC.

))) **The role of price in the growth of electricity productivity**

"The effectiveness of price as an instrument for getting the kinds of environment efficiency changes that we would like to see for environmental reasons is overestimated most of the time... Energy commodity price increases are probably a necessary condition for sustained efficiency improvement, but in many parts of the economy it would appear the price signal itself is not sufficient... people don't demand fuel and electricity; they demand the service... it's not so much the price of fuel and electricity that's going to matter but the price of doing whatever it is that the energy is contributing to."

Ralph Torrie ICF INTERNATIONAL

))) **Labour shortage and skill incompatibility in the energy sector**

"Speaking as an association that represents a number of very large companies that are hiring advanced science and technology people potentially all of the time, there has been, and there continues to be, a slow degradation of literacy and numeracy skills of people who are coming to our companies and various institutions looking for work. This is not the fault of the students; it isn't that the students are any less intelligent than they were 10 years ago. It's that there were a number of things done in pedagogy in public schools, and to an extent in high schools, which have degraded those skills."

Colin Hunt CANADIAN NUCLEAR ASSOCIATION

"[there is] an initiative from another community college (Centennial)... to educate and train people to operate what will be renewable energy system plants in the future... co-committee members of mine are two vice-presidents of the Canadian Union of Skilled Workers and they state categorically that the present operators' tickets are limited, that their membership five years from now will be people with tickets that don't exist right now and the operators will not be assigned to opening and closing valves and switches. They'll be working with computers and interlocks, interfaces and monitoring equipment, and their pay scale will go up, their standards of operation will go up and job satisfaction will go up, and that is all good news. None of these people or these qualifications exists today."

Michael Rich RENEWABLE ENERGY GENERATION INC.

²⁷For more information on Natural Resources Canada's Office of Energy Efficiency initiative designed to help federal departments and agencies reduce energy and water consumptions and greenhouse gas emissions, visit: <http://oee.nrcan.gc.ca/communities-government/buildings/federal/federal-buildings-initiative.cfm?attr=0> .





"We take a balkanized, fragmented approach to energy and I think it would be very beneficial to have a central focus on energy, studying it from an analyst's point of view, looking at all the possibilities, including conservation... We have a lot of politicians that don't have the knowledge to make decisions in a holistic manner. They don't often understand the consequences and the possibilities and opportunities that would make more sense. I'm sure that the National Energy Board, the OPA, the OEB, and a number of other organizations would like people who actually spent four years studying energy in a holistic manner..."

Judy Smith TORRIE SMITH ASSOCIATES

"Given the time scales over which we need to take some action, it's clear to me that we need to invest to ensure our children become energy literate. This has to be one of the best potential returns on an investment that we can have... I think one of the possible avenues is something similar to STDC. Everybody has lauded this program for its impact on allowing various companies and technologies to be deployed in the field and demonstrated in Canada. We need an equivalent sustainable technology education fund that would be available across the country in a non-prescriptive manner to encourage innovation, to encourage novel partnerships between schools and the private sector, to spawn a variety of programs that would ensure we end up in fifteen years time with children and a workforce that are energy literate ..."

Ned Djilali UNIVERSITY OF VICTORIA

))) Canada's position regarding Kyoto

"Let me be blunt, Canada has the worst deal of any who remains committed to Kyoto. There are all sorts of aspects to the agreement that are silly and need to be rethought. And Canada needs to be better prepared for the next round of negotiations, knowing what is achievable here is not simply a copy of the U.S."

Hadi Dowlatabadi University of British Columbia

"The targets and timetables in the Kyoto Accord are the result of the political circumstances at the time, but much has changed since then, most notably the hardening of the scientific consensus that we need to act urgently to bring down anthropogenic emissions... In comparison to the foundation for international cooperation laid down by the Protocol, the targets and timetables of this first round are of less lasting significance. They never were sufficient to make much difference climatologically, but they did serve and continue to serve the purpose of grounding the international effort..."

Ralph Torrie ICF INTERNATIONAL



Evergreen Papers

Special Session on Research and Evergreen Papers

David Moorman SENIOR POLICY ADVISOR
SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL (SSHRC)

CONTEXT

Over the past few decades, a great deal of research has been conducted on climate change and the possible paths towards a low carbon society. It is often difficult for policy makers, citizen groups and private sector firms to access the research results in this fast moving field of study in a way that is useful, pragmatic and comprehensive. As well, the research has often lacked focus on exploring questions of immediate relevance to the users of such knowledge, or has not gotten beyond academic discussions. If we are to be successful in building a low carbon future, the knowledge, expertise and investigative capacity of the academic community must be mobilized and drawn upon to address a wide variety of crucial issues related to both technology development and the social, economic, cultural and legal aspects of moving away from fossil fuels towards low carbon sources and carriers of energy.

OBJECTIVES AND FOCUS

The objectives of this special session were to explain a research effort at the University of Victoria Centre for Global Studies and provide examples of how research support can contribute to our understanding of the social, economic, political and institutional barriers to building a low carbon society.

Harry Swain EXECUTIVE DIRECTOR, CANADIAN INSTITUTE FOR CLIMATE STUDIES,
THE CENTRE FOR GLOBAL STUDIES, UNIVERSITY OF VICTORIA

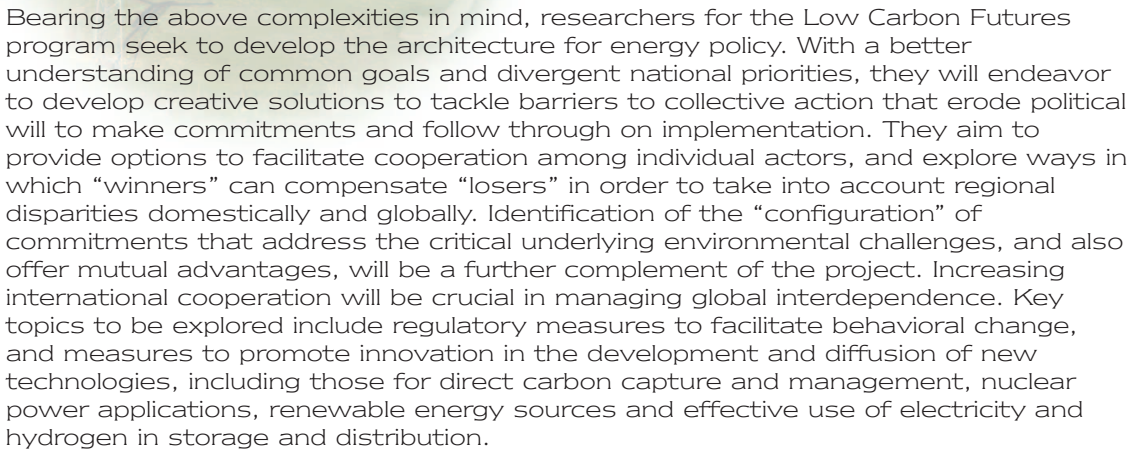
“Description of the Low Carbon Futures Research Program”²⁸

The Low Carbon Futures research program is an initiative led by the Centre for Global Studies (CFGS) working intensively with academic partners and think tanks in Canada and abroad. The purpose of the program is to chart a route to a low carbon future (Appendix 1). This entails changes in Canadian climate and energy policy, investment, R&D and regulatory approaches. The international dimension requires development of a successor approach to the Kyoto protocol, a global “grand bargain” that will be seen as a legitimate, pragmatic and mutually advantageous energy-policy package.

The current challenge is to explore a palatable “climate-constrained energy policy”. This challenge requires careful precautionary action, given the uncertainties surrounding the scale and distribution of the risks of climate change. Additionally, any national approach must take into account the risk of inadequate implementation at local levels. Any decision making process involved must be accepted as legitimate and fair by those whose compliance is essential, despite short run costs they might incur.

²⁸As a follow-up to the “Building Paths to a Low Carbon Society” Workshop, The University of Victoria, Centre for Global Studies is developing a multi-year international project to develop and support a series of senior expert/decision-maker workgroups examining focused questions related to identifying and diagnosing present sources of blockage in mitigation policy, and identifying, elaborating, and evaluating promising paths forward. For more information reference Ted Parson’s Participant Perspective Statement at: www.ivey.uwo.ca/lawrencecentre/energy/statements.htm .





Bearing the above complexities in mind, researchers for the Low Carbon Futures program seek to develop the architecture for energy policy. With a better understanding of common goals and divergent national priorities, they will endeavor to develop creative solutions to tackle barriers to collective action that erode political will to make commitments and follow through on implementation. They aim to provide options to facilitate cooperation among individual actors, and explore ways in which “winners” can compensate “losers” in order to take into account regional disparities domestically and globally. Identification of the “configuration” of commitments that address the critical underlying environmental challenges, and also offer mutual advantages, will be a further complement of the project. Increasing international cooperation will be crucial in managing global interdependence. Key topics to be explored include regulatory measures to facilitate behavioral change, and measures to promote innovation in the development and diffusion of new technologies, including those for direct carbon capture and management, nuclear power applications, renewable energy sources and effective use of electricity and hydrogen in storage and distribution.

A key feature of the Low Carbon Futures program will be the on-going development of a set of “evergreen papers”, or state of knowledge summaries of current research that can be used by policy makers to keep abreast of the latest understanding on particular energy policy issues. The suite of evergreen papers will cover both current and emerging issues around, for example, nuclear energy, clean coal, hydrogen, and carbon sequestration.

Dr. Guy Holburn ASSISTANT PROFESSOR
RICHARD IVEY SCHOOL OF BUSINESS, UNIVERSITY OF WESTERN ONTARIO
“Institutions, Commitment and Public Policy: Electricity Regulation in Ontario and the U.S.”

An example of the types of research that can be used to inform policy making in the area of energy production and use was presented.²⁹ The research focuses on the role that public institutions play in the design of public policies and the impact on industrial performance. The basic research questions motivating this research are how does the structure of policy making institutions affect public policies, what degree of stability or instability do they bring to policy implementation and how does this affect industry investment. These questions were applied to a comparative analysis of the electricity sectors in Ontario and the U.S.

The research indicates that institutional structures that promulgate regulatory policies that are insulated against political intervention will lead to more stable and predictable policy regimes and hence greater levels of infrastructure development. These findings have significant implications for the future of electricity regulation in Ontario and future private sector investments in renewable energy technologies.

²⁹Read Dr. Holburn’s Evergreen Paper, “Institutions, Commitment and Public Policy: Electricity Regulation in Ontario and the U.S.”, posted on the Lawrence National Centre’s webpage: www.ivey.uwo.ca/lawrencecentre/energy/report.htm .

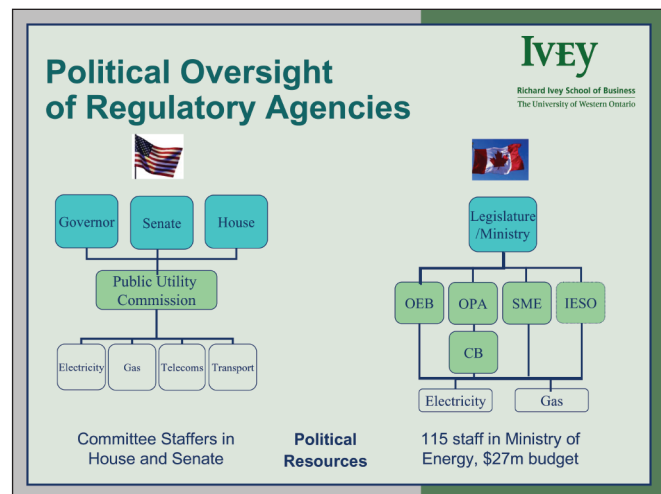




In most U.S. states, utility regulatory expertise is centered in a single agency, commonly the Public Utility Commission (PUC). PUCs regulate electricity, gas and local telecoms industries, and in some instances transport and insurance too, within state boundaries. Political oversight of Public Utility Commissions is fragmented and distributed across a number of executive and legislative bodies. The governor, the senate and the house jointly have responsibility for enacting legislation that can modify the mandate of the state PUC. They also jointly determine agency budgets and appointments. This shared oversight has the effect of limiting political interference in the regulatory process and creates relative stability in policy regimes. Since electricity facilities are generally long term, large capital investments, private sector investors are attracted to such regimes.

The institutional structure in Ontario provides a contrast to that of the average U.S. state. The Ontario Energy Board has primary responsibility for regulating rates and infrastructure investments in the electricity and gas industries. Since 1998, however, additional regulatory agencies have been created with specific mandates, including the Ontario Power Authority, the Conservation Bureau, the Electrical Safety Authority and the Ontario Electricity Financial Corporation. Further, as part of Bill 21 in March 2006, the government announced its intention to establish an additional

agency, a 'Smart Meter Entity', which will have responsibilities regarding the implementation of new metering technology. Political oversight is concentrated in the legislative assembly and the office of the Minister of Energy. Regulatory policy is thus much more exposed to political intervention than in the U.S. This can lead to relative instability in policy making and application. In Ontario, it is relatively easy for a new (or existing) government to pass new legislation or to require regulatory agencies to adjust policies. This increases the political risk for long term private sector investment in the electricity sector and is hence likely to reduce the level of private sector activity. Risks are especially acute for large scale investments (for instance, new power generation stations) and for low carbon generation technologies that are costly relative to conventional fuel technologies.





DISCUSSION AND SELECTED QUOTES

The discussion following the presentation focused on a number of issues, including:

))) **Need for long term vision and commitment**

"...I think it's important that we recognize that the climate debate is focused too much on Kyoto, as opposed to a multi-decade or long term focus... the questions of energy security, economic efficiency, the whole role of investors will be... major drivers in meeting long-term emission reduction targets - more than 50% reductions in global emissions are needed to stabilize the atmospheric concentrations. Kyoto will have only a small impact on concentrations but it's important in a political policy sense and international process sense..."

Gordon McBean UNIVERSITY OF WESTERN ONTARIO

))) **The impact of population growth in the climate change challenge**

"The United States will grow to 400 million people in 50 years and they all want to be like other Americans... The Chinese government, as is India, is heavily subsidizing energy. Why? Because they want to grow. They realize that the United States, Canada and other so called advanced countries built their economies on the basis of cheap energy... population and the idea of people wanting better lives may go against what we are all trying to achieve."

Joe Visalli NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA)

"It's very, very clear that as the Chinese want to emulate our standards of living, they are going to go from consuming 1.5 barrels of oil per annum per person to some measurable fraction of the American experience, which is about 24. As they do that... the proportion of green house gases that come from China is going to outstrip the United States by some large margin... this is where I come back to the notion that persuading the Chinese that they can get to a standard of living while not using 24 barrels a person but maybe 10 has got to be incredibly high on our agenda..."

Michael Brown CHRYSALIX ENERGY VENTURE CAPITAL

))) **Canada's unique position regarding climate change**

"...why should Canada play any role in reducing its 2% emissions? The reality is that we are a most impacted nation. We will see more impacts of climate change in Canada than will be seen on most countries due to the fact that we are an arctic and a forested country... What we have to do is... work internationally so that other countries will make the initial reductions as part of a global effort."

Gordon McBean UNIVERSITY OF WESTERN ONTARIO

))) **The need for funding towards academic public policy research**

"...if you look at the distribution of money that has gone into academia, the majority has gone into what I would call primarily the technological innovation agenda. We have neglected to fund research on the public policy aspects of why do government at all levels make... decisions. How do we generate the kind of research in academia that feeds into what is good decision making..."

Gordon McBean UNIVERSITY OF WESTERN ONTARIO





))) **Integrating low carbon and clean air issues**

"I do think the connecting of clean air and reducing smog, if you do it intelligently, does create some benefits for CO₂ and vice versa... It comes back to... political incentive; if you reduce smog you get the benefits tomorrow and the election results next month... If you reduce CO₂ emissions you get the benefits decades from now... We should be talking about low carbon and low smog issues in an integrated way."

Gordon McBean UNIVERSITY OF WESTERN ONTARIO

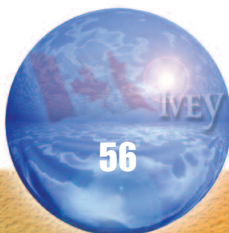
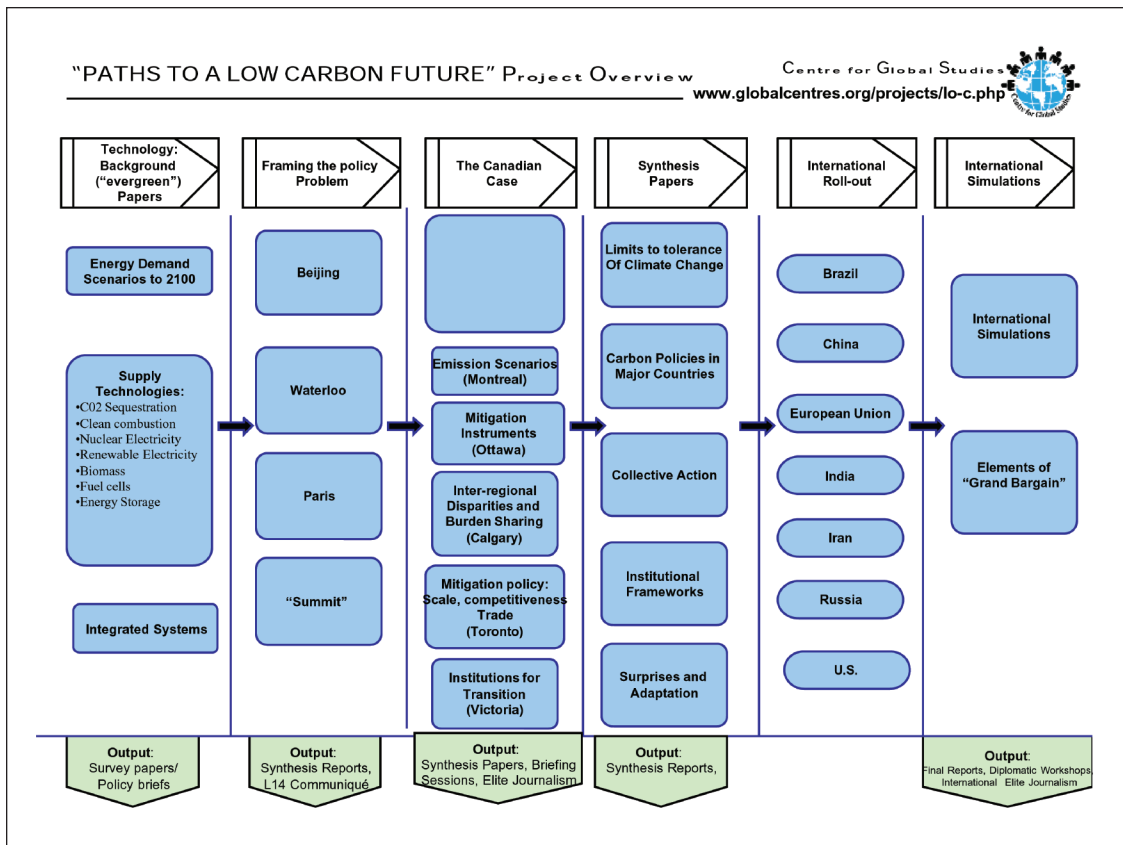
"You can pursue an anti-smog regime through technologies that do nothing for climate change and in fact probably exacerbate climate change by putting scrubbers and particulate catchers on smoke stacks. Or you can take a much smarter approach to displacing carbon based technologies from that market base and get a double benefit of climate and smog protection..."

Michael Brown CHRYSALIX ENERGY VENTURE CAPITAL





APPENDIX 1



IVEY

Participant Perspective Statements

Participant statements were submitted to the workshop as an optional addition to the discussions. These statements were made on a voluntary basis, and reflect the opinions and expertise of the authors. The statements contain a wealth of information, as they were submitted by representatives from academia, business, all levels of government, as well as non-governmental organizations, and reflect their perspectives on the challenges and opportunities facing government. A number of recommendations, thus offering more tools for implementation, were provided to guide governments in the development and implementation of sustainable energy policy.

It was reiterated, from reading through the collection of participant statements, that there is not one solution that will lead a transformation to a low carbon society. We will need a comprehensive effort directed towards cleaner supply options, reducing demand and improving energy efficiency, noting that within each of these areas a variety of solutions can be found that meet the need from a local scale to a global scale.

On the supply side of the equation, a variety of options within the emerging suite of new technologies were highlighted, such as, the new technologies and techniques coming to market to improve fuel efficiency and to reduce emissions in the transportation sector, the interconnection of the by-products and technologies in the agriculture and energy sectors and the potential for increasing development of “by-product and waste management” in all sectors. The statements also emphasized the crucial role of government in levelling the playing field and stimulating demand for low carbon technologies. The government was instrumental as a partner in supporting Canada’s leading position in hydrogen and fuel cell technology and in developing the technology to convert biomass into cellulose ethanol. The participant statements noted the importance of hedging our energy sources through effective diversification and acknowledged that Canada has a unique potential to become a world leader in Renewable Bio-Energy Systems.

The demand side of the equation is equally important to meeting our goal of building a low carbon society. We have long believed that we have an unlimited supply of inexpensive energy and are only now recognizing the adverse effects of fossil-fuel based energy sources. We must reduce our energy use, be it fossil-fuel based or renewable, by increasing energy efficiency and conserving through demand-management. The statements highlighted a number of interesting initiatives currently underway, including, London’s EnerGuide Partnership promoting energy conservation in the residential sector; the University of Western Ontario’s use of Hartman Loop technology and use of construction specifications set to Green Building and LEEDS standards; London Hydro’s conversion of incandescent-based traffic and pedestrian signals to energy efficient state-of-the-art light-emitting diode (LED) technology, and their residential appliance recycling program; as well as NRCan’s Energy Management Training program. Statements also provided recommendations on how Smart Metres will have maximum impact on social change, the role of private-public partnerships and suggestions on leveraging Bill 21.

This is a brief summary of the topics considered within the Participant Statements. To access the statements, visit the Lawrence Centre website at:
<http://www.ivey.uwo.ca/lawrencecentre/energy/statements.htm>



IVEY

Participant Perspective Statements CONTINUED

The following participants submitted participant perspective statements:

1. **Pierre Rivard** *EXECUTIVE CHAIRMAN* Hydrogenics
2. **Bryan Swift** *DIRECTOR OF ENVIRONMENTAL ACTIVITIES* General Motors of Canada
3. **Maurice Hladik** *DIRECTOR OF MARKETING* Iogen Corporation
4. **Mike Brown** *EXECUTIVE DIRECTOR AND CHAIRMAN* Chrysalix Energy Venture Capital
5. **Graham Campbell** *DIRECTOR GENERAL* Office of Energy Research and Development
Natural Resources Canada
6. **Jaret Henhoeffter** *GENERAL MANAGER* Perth Community Futures
7. **Dave Riddell** *ASSOCIATE VICE-PRESIDENT* (Physical Plant and Capital Planning)
University of Western Ontario
8. **Tyler Hayes** *PHD CANDIDATE* Geophysics & Scientific Computing, University of Western Ontario
9. **Patrick J. Boyer, Q.C.** *CHAIR OF EDUCATION* Breakout Educational Network
10. **Andrew T. B. Stuart** *CHAIRMAN* Sustainability Shift Inc.
11. **Vinay Sharma** *VICE-PRESIDENT* Customer Service and Strategic Planning, London Hydro
12. **Phil Dick** *INVESTMENT DEVELOPMENT OFFICER* Investment Development Unit
Food Industry Competitiveness Branch, Innovation and Competitiveness Division
Ontario Ministry of Agriculture, Food and Rural Affairs
13. **Helmut Sieber** *PRESIDENT* Canadian Agra Inc.
14. **Geoff Cargill** *REGIONAL VICE PRESIDENT* Bell Canada Enterprises Inc.,
Gary Paul *VICE PRESIDENT* Utilities Practice Capgemini
Gord Reynolds *UTILITIES AND ENERGY LEAD* Capgemini
15. **Mohan Mathur** *BOARD OF DIRECTORS* London Hydro
16. **Jeff Fielding** *CAO* City of London
17. **John W. Tak** *PRESIDENT AND CHIEF EXECUTIVE OFFICER* Hydrogen & Fuel Cells Canada
18. **William R. Tharp** *CHIEF EXECUTIVE OFFICER* The Quantum Leap Company Limited
19. **Parson, Edward** *SENIOR RESEARCH ASSOCIATE* Centre for Global Studies,
University of Victoria (2006-2007) & Professor of Law and Professor of Natural
Resources and Environment, University of Michigan



IVEY

Workshop Participant List

BUSINESS, GOVERNMENT, NON-GOVERNMENT AND ACADEMIC PARTICIPANTS

- Abbott, Clint** ASSISTANT DIRECTOR, Centre for Global Studies, University of Victoria
- Adams, Joel** DIRECTOR, University of Western Ontario Research and Development Park, University of Western Ontario
- Ariss, Alison** CONSULTANT, Research Development, University of Western Ontario
- Ayyad, Hanna** VICE PRESIDENT, Operations, Canadian Agra Inc.
- Bailey, Robert C.** DIRECTOR, Environmental Research Western, University of Western Ontario
- Bentley, The Honourable Christopher** MINISTER OF TRAINING, Colleges and Universities, MPP London West, Government of Ontario
- Berruti, Franco** DEAN, Faculty of Engineering, University of Western Ontario
- Boyer, J. Patrick, Q.C.** Chair of Education, Breakout Educational Network
- Brown, Michael** EXECUTIVE DIRECTOR & CHAIRMAN OF THE BOARD, Chrysalix Energy Venture Capital
- Buijk, Jan** VICE PRESIDENT & GENERAL MANAGER, GE Energy Jenbacher
- Campbell, Bruce** VICE PRESIDENT, Corporate Relations & Market Development, Independent Electricity System Operator (IESO)
- Campbell, Graham** DIRECTOR GENERAL, Office of Energy Research & Development, Natural Resources Canada
- Cargill, Geoff** REGIONAL VICE PRESIDENT, Bell Canada Enterprises Inc.
- Carin, Barry** ASSOCIATE DIRECTOR, Centre for Global Studies, University of Victoria
- Cecchini, Perry** MANAGER OF RENEWABLE ENERGY SUPPLY, Ministry of Energy, Government of Ontario
- Chahine, Richard,** DIRECTOR, Hydrogen Research Institute, NSERC Hydrogen Industrial Research Chair of Hydrogen Storage, Dept. of Physics, Université du Québec a Trois-Rivières
- Chan, Kevin** EXECUTIVE ASSISTANT TO THE DEPUTY SECRETARY TO THE CABINET (OPERATIONS), Privy Council Office, Government of Canada
- Cowan, Nancy** EXECUTIVE DIRECTOR, Development (Canada), FPL Energy, (Former Managing Director, Ontario Centres for Excellence - Centre for Energy)
- Cunningham, Dianne** DIRECTOR, The Lawrence Centre for Policy and Management, Richard Ivey School of Business, University of Western Ontario
- Dagnone, Tony** CHAIR, The Change Foundation
- Dalziel, Jane** DIRECTOR OF COMMUNICATIONS & GOVERNMENT RELATIONS, Hydrogenics
- Davenport, Paul** PRESIDENT, University of Western Ontario
- Dick, Phil** INVESTMENT DEVELOPMENT OFFICER, Investment Development Unit, Food Industry Competitiveness Branch, Innovation & Competitiveness Division, Ministry of Agriculture, Food and Rural Affairs, Government of Ontario
- Djilali, Ned** CANADA RESEARCH CHAIR IN ENERGY SYSTEMS DESIGN AND COMPUTATIONAL MODELS AND DIRECTOR, Institute for Integrated Energy System (IESVic), University of Victoria
- Dowlatabadi, Hadi** PROFESSOR, Institute for Resources, Environment and Sustainability, University of British Columbia
- Ellis, Judy** EXECUTIVE ASSISTANT TO THE DEAN, The Lawrence Centre for Policy and Management, Richard Ivey School of Business, University of Western Ontario



IVEY

Workshop Participant List CONTINUED

- El Naggar, Hesham** *ASSOCIATE DEAN*, Research & External Relations, Faculty of Engineering, University of Western Ontario
- Ewart, Tom** *MANAGING DIRECTOR*, The Research Network for Business Sustainability & Research, Richard Ivey School of Business, University of Western Ontario
- Fielding, Jeff** *CHIEF ADMINISTRATIVE OFFICER*, City of London
- Fitzgibbons, Kevin** *EXECUTIVE DIRECTOR*, Office of the National Science Advisor, Government of Canada
- Fraser, Marion** *SENIOR POLICY ADVISOR*, Ministry of Energy, Government of Ontario
- Fraser, Peter** *MANAGER*, Wholesale Power Policy, Regulatory Policy Development, Ontario Energy Board
- Gall, Cathy** *CO-ORDINATOR*, Environmental/Science Lab Programs, Fanshawe College
- Gallant, Bob** *PRESIDENT & CEO*, GreenField Ethanol Inc.
- Geneau, Nicole** *MANAGER*, Skills Development, Ontario Centres of Excellence, Government of Ontario
- Gillis, James** *DEPUTY MINISTER OF ENERGY*, Government of Ontario
- Gordon, Melissa** *CONSULTANT*, Research Development, University of Western Ontario
- Halliwell, Janet** *EXECUTIVE VICE-PRESIDENT*, Social Sciences and Humanities Research Council of Canada (SSHRC)
- Hall, Jim** *MANAGER*, Business Integration, Hydro One
- Henhoeffer, Jaret** *GENERAL MANAGER*, Perth Community Futures
- Henning, Mark** *CO-ORDINATOR*, Math Programs & Professor, Environmental and Science Lab Programs, Fanshawe College
- Hewitt, Ted** *VICE-PRESIDENT OF RESEARCH*, University of Western Ontario
- Higgins, Gerry** *PROFESSOR*, Richard Ivey School of Business, University of Western Ontario
- Hladik, Maurice** *DIRECTOR OF MARKETING*, Iogen Corporation
- Hogarth, Don** *PRESIDENT*, Hogarth Communication Inc.
- Holburn, Guy** *ASSISTANT PROFESSOR*, Richard Ivey School of Business, University of Western Ontario
- Huner, Norm** *SCIENTIFIC DIRECTOR*, Biotron Institute for Experimental Climate Change Research, University of Western Ontario
- Hunt, Colin** *DIRECTOR, RESEARCH AND PUBLICATIONS*, Canadian Nuclear Association
- Johnson, Gillian** *The Lawrence Centre for Policy and Management*, Richard Ivey School of Business, University of Western Ontario
- Johnson, Peter C.** *CHAIR*, London Hydro Inc. and Partner, Lerners LLP
- Keith, David** *CANADA RESEARCH CHAIR IN ENERGY AND THE ENVIRONMENT*, Department of Chemical and Petroleum Engineering and Department of Economics, University of Calgary
- Kelly, Brian** *DIRECTOR*, Sustainable Enterprise Academy, Schulich School of Business, York University
- Kidder, Gerald** *ASSOCIATE VICE PRESIDENT (RESEARCH)*, University of Western Ontario
- Klassen, Bob** *Hydro One Faculty Fellow in Environmental Management*, Richard Ivey School of Business, University of Western Ontario
- Knox, Kenneth** *PRESIDENT & CEO*, Innovation Institute of Ontario
- Knubley, John** *ASSOCIATE DEPUTY MINISTER*, Natural Resources Canada



IVEY

Workshop Participant List CONTINUED

- Kulczycki, Gitta** *VICE PRESIDENT (RESOURCES AND OPERATIONS)*, University of Western Ontario
- Little, Ryan** *PARTNER*, Storm Fisher Inc.
- Malpass, Jeff** *GENERAL MANAGER*, Siemens Canada Ltd.
- Mathur, Mohan** *BOARD OF DIRECTORS*, London Hydro
- Massoumi, Guiti** *SENIOR CONSULTANT*, Research Development, University of Western Ontario
- McBean, Gordon** *RESEARCH CHAIR*, Institute of Catastrophic Loss Reduction and Professor, Department of Geography, University of Western Ontario
- Monteith, Russ** *BOARD OF CONTROL*, City of London
- Moorman, David**, *SENIOR POLICY ADVISOR*, Social Sciences and Humanities Research Council of Canada (SSHRC)
- Morse, Eric** *EXECUTIVE DIRECTOR*, The Institute for Entrepreneurship, Richard Ivey School of Business, University of Western Ontario
- Mounteer, Lesley** *MANAGER*, External Services, Western Engineering, University of Western Ontario
- Murray, Glen**, *PRINCIPAL*, Navigator Limited and Chair, National Round Table on the Environment and the Economy (NRTEE)
- Newton, Derek** *CONSULTANT*, Research Development, University of Western Ontario
- Nowina, Pamela** *VICE-CHAIR*, Ontario Energy Board
- Ogilvie, Ken** *EXECUTIVE DIRECTOR*, Pollution Probe
- Ogram, Geoff** *VICE PRESIDENT*, Asset Management, Hydro One
- Parson, Edward** *PROFESSOR OF LAW*, Professor of Natural Resources and Environment, University of Michigan and Senior Research Associate, Centre for Global Studies, University of Victoria (2006-2007)
- Paul, Gary** *VICE PRESIDENT*, Utilities Practice, CapGemini
- Penner, Gregory** *PRESIDENT & CEO*, NeoVentures Biotechnology Inc.
- Rathwell, Kent** *PRESIDENT*, Agri Promotions Canada Ltd.
- Reynolds, Gord** *UTILITIES AND ENERGY LEAD*, CapGemini
- Rich, Michael** *VICE PRESIDENT*, Renewable Energy Generation Inc.
- Riddell, Dave** *ASSOCIATE VICE PRESIDENT (PHYSICAL PLANT AND CAPITAL PLANNING)*, University of Western Ontario
- Rivard, Pierre** *EXECUTIVE CHAIRMAN*, Hydrogenics
- Roberts, John** *DIRECTOR*, Environment, Energy and Transportation, Conference Board of Canada
- Rodrigues, Luis** *GENERAL MANAGER FOR ENERGY SOLUTIONS*, Honeywell Canada
- Roman, Samantha** *GRADUATE LEADERSHIP PROGRAM ASSOCIATE*, RBC Royal Bank
- Romoff, Mark** *PRESIDENT & CEO*, Ontario Centres of Excellence, Government of Ontario
- Schmidt, Bonnie**, *PRESIDENT*, Let's Talk Science
- Shapiro, Stephen** *MANAGING DIRECTOR*, BMO Capital Markets Diversified Industries Group
- Sharma, Vinay** *VICE PRESIDENT*, Customer Service and Strategic Planning, London Hydro
- Sharpe, Vicky** *PRESIDENT & CEO*, Sustainable Development Technology Canada (SDTC)



IVEY

Workshop Participant List CONTINUED

- Sidhu, Tarlochan** *DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, University of Western Ontario*
- Sieber, Helmut** *PRESIDENT, Canadian Agra Inc.*
- Simonovic, Slobodan** *PROFESSOR, Department of Civil and Environmental Engineering, University of Western Ontario and Director, Engineering Studies, Institute for Catastrophic Loss Reduction, University of Western Ontario*
- Simpson, Donald** *CHIEF EXPLORER, Innovation Expedition and Hub Unit Mentor, EnergyNet*
- Simpson, Jeffrey** *NATIONAL AFFAIRS COLUMNIST, The Globe and Mail and Lawrence National Centre Advisory Council, Richard Ivey School of Business, University of Western Ontario*
- Sinai, Dan** *MANAGER, Research Development, University of Western Ontario*
- Sinclair, Beth** *LOGISTICS CO-ORDINATOR, Richard Ivey School of Business, University of Western Ontario*
- Singh, Amar** *MANAGER OF BUSINESS OPERATIONS, Biotron Institute for Experimental Climate Change Research, University of Western Ontario*
- Smith, William (Bill)** *VICE PRESIDENT, Power Generation, Siemens Canada*
- Smith, Judy** *PRESIDENT Torrie Smith Associates*
- Speers, Doug** *EXECUTIVE BOARD CHAIR, Canadian Industry Program for Energy Conservation and Member, Ivey Alumni Association Board of Directors, Richard Ivey School of Business, University of Western Ontario*
- Stephenson, Carol** *DEAN, Richard Ivey School of Business, University of Western Ontario*
- Stevenson, Allison** *COMMUNICATIONS OFFICER, Western Engineering, The University of Western Ontario*
- Stuart, Andrew** *PRESIDENT & CEO, Sustainability Shift Inc.*
- Swain, Harry** *EXECUTIVE DIRECTOR, Canadian Institute for Climate Studies, Centre for Global Studies, University of Victoria*
- Sweeney, Tom** *MANAGING DIRECTOR & CO-FOUNDER, Garage Technology Ventures Canada*
- Swift, Bryan** *DIRECTOR OF ENVIRONMENTAL ACTIVITIES, General Motors Canada*
- Tak, John** *PRESIDENT & CEO, Hydrogen and Fuel Cells Canada*
- Tessier, Todd** *DIRECTOR, International Capital Markets, Investment Capital Branch, Ministry of Economic Development, Province of British Columbia*
- Tharp, William** *CEO, Quantum Leap Company Ltd.*
- Torrie, Ralph** *VICE PRESIDENT, ICF International*
- Van Berkel Bas** *PARTNER, Storm Fisher Inc.*
- Vander Laan, Hank** *FOUNDER & SENIOR ADVISOR, Trojan Technologies*
- Visalli, Joe** *DIRECTOR, Energy Resources, Transportation and Power Systems, and Environment, New York State Energy Research and Development Authority (NYSERDA)*
- Walker, Wayne** *MARKET LEAD, Honeywell Energy Solutions*
- Watts, Bernie** *CEO, London Hydro*
- Weil, Mary** *MANAGER, Media and Public Relations, University of Western Ontario*
- Wildeman, Alan** *VICE PRESIDENT, Research, University of Guelph*
- Wilkes, Andrew** *CHAIRMAN, National Angel Organization & Partner, Management Initiatives Inc.*



IVEY

Workshop Participant List CONTINUED

STUDENT/VOLUNTEER PARTICIPANTS

- Baker, Brad** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Bignell, Andrew** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Buckstein, Aaron** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Callum, David** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Carter, Kevin** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Davies, Evan** *Ph. D.*, Civil and Environmental Engineering, University of Western Ontario
- Golinowski, Craig** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Hangan, Horia** *WIND ENGINEERING*, Boundary Layer Wind Tunnel Laboratory and Western Engineering, University of Western Ontario
- Howard, Brendan** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Hui, Jenny** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Jacobson, Mike** *GRADUATE STUDENT*, Agritherm/Wester Fluidization Group, University of Western Ontario
- Jennings, Graeme** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Kelly, John** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Liebrock, Mike** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- MacDonald, Rebecca** *Ph.D.*, Geology, University of Western Ontario
- Mohan, Prasanna** *PH. D.*, Engineering, University of Western Ontario
- Nambiar, Rajiv** *MBA CANDIDATE 2007*, Ivey Builds, Richard Ivey School of Business
- Parmar, Shan** *HBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Richard, Chad** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Saha, Madhu** *NANOTECHNOLOGY*, Western Group, University of Western Ontario
- Singer, Eric** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Tsacnakos, Ismene** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Viswanathan, Vijay** *MBA 2007*, Richard Ivey School of Business
- Wanger, Greg** *PH.D. CANDIDATE IN EARTH AND ENVIRONMENTAL SCIENCE*, Department of Earth Sciences, Environmental Research Western, University of Western Ontario
- Wright, Kevin** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario
- Yiu, Ivan** *MBA 2007*, Richard Ivey School of Business, University of Western Ontario



Ivey

Acknowledgements

The Developing Sustainable Energy Policy Workshop could not have been possible without the many people who shared their valuable time to make the workshop a success. I extend my thanks to those who were instrumental to the task of organizing the workshop and in assisting in the writing of this report. It was a privilege to be involved with so many people who made themselves available to work towards guiding future policy development in Canada. In particular, I would like to thank Carol Stephenson, Dean of the Richard Ivey School of Business, who provided ongoing advice and encouragement, as well as Paul Davenport, President and Vice-Chancellor of the University of Western Ontario, and Ted Hewitt, Vice-President (Research and International Relations), University of Western Ontario, for their ongoing support.

I am deeply grateful to the panel chairs, Vicky Sharpe, David Moorman, Pamela Nowina, Kevin Fitzgibbons and Ken Ogilvie, and the panelists, Andy Wilkes, Todd Tessier, Mike Brown, Bill Tharp, Tom Sweeney, Harry Swain, Guy Holburn, Geoff Ogram, Bill Smith, Glen Murray, Pierre Rivard, Maurice Hladik, Bryan Swift, Graham Campbell, Ralph Torrie, Gary Paul, and Bonnie Schmidt for dedicating their time and expertise. Their insightful presentations led to engaging debates on pressing policy options and concrete action. Many of our panel chairs and panelists contributed to the writing of this report and I thank them for their ongoing commitment of time and expertise. As well, many participants approved their quotations for publication. Your thoughts truly made the report come alive!

Students from Ivey as well as other Western programs contributed significantly. They shared their time and enthusiasm to meet with us prior to the conference on a number of occasions. They assisted throughout the workshop, including transcribing presentations and discussions. Students also participated in a seminar presented by Kevin Chan, Privy Council Office. His presentation was of great interest to our students and I would like to thank Kevin for his vision and commitment to our next generation of leaders.

Thank you to students, staff, and professors who contributed to the preparation and delivery of the “60-second pitches”. Thank you to Franco Berruti, Hesham El Naggar, Lesley Munteer, Allison Stevenson, and the Faculty of Engineering for coordinating these efforts. The presentations were a great way to showcase research and development at the University of Western Ontario.

Several government officials took interest in our workshop and encouraged us along the way. I extend appreciation to Minister Donna Cansfield, Minister Dwight Duncan, and Minister Christopher Bentley at the Government of Ontario, as well as their officials James Gillis, Perry Cecchini, Bonnie Hiltz, and Marion Fraser who brought enthusiastic greetings at our opening reception. The Ontario Centres of Excellence, Centre for Energy, were helpful in the design of the background paper and selection of panelists. I thank Nancy Cowan, Nicole Geneau, Mark Romoff, David McFadden and Dan McGillivray for their ongoing support from the very beginning. Janet Halliwell and David Moorman at SSHRC were instrumental in encouraging us to host this workshop and guiding us with wisdom over the past eighteen months. I extend my thanks to the officials at NRCan, Deputy Cassie Doyle for her support and interest, Associate Deputy John Knubley, who participated in the entire proceedings, as well as to Director General Graham Campbell for his expert advice as a member of our steering committee. To the City of London, who continues to support Ivey in so many ways, I extend my appreciation to Jeff Fielding for his participant statement and ongoing advice and to Russ Monteith for his warm welcome at the opening reception on behalf of the City of London.



IVEY

Acknowledgements CONTINUED

Our municipal and business sponsors are leaders in embracing environmentalism and a low carbon future. Bernie Watts, Mohan Mathur, Vinay Sharma and Nancy Huttons from London Hydro, Geoff Cargill from Bell Canada, Gord Reynolds from Cargemini, and Luis Rodrigues from Honeywell are examples of those who made the time and have the skills and capabilities to help get these issues into a broader public domain where they can be debated. I thank them for their leadership and generosity of time.

In the beginning, it was Barry Carin and his colleagues at the Centre for Global Studies, University of Victoria, who encouraged us to take on this project. Thank you, Barry, it has been a rewarding challenge!

Leading up to the workshop, Bas van Berkel and Ryan Little worked diligently to prepare a background report for our participants. I am appreciative of their hard work and their ongoing interest.

Thank you to Joe Visalli from NYSERDA who was our keynote speaker who encouraged our students and participated throughout the entire proceedings.

Behind the scenes there were a number of individuals who worked tirelessly to ensure that the workshop went off without a hitch and that the report was well prepared. I want to thank Judy Ellis, Jane Weller, Bob Papanikolaou, Kimberly Hamilton, Sherri Moore, Jill Tiviluk, Steve Martin, Diana Smithson, Samantha Roman, Tom Ewart and Elka Walsh. Thank you to Tony Nicoletti and Kate Hewitt at Carter's Printing of London Ltd. for their dedicated work and understanding in the process of publishing this report.

I want to express my appreciation to David Keith from the University of Calgary for delivering the closing remarks, which provided the direction for many of the thoughts that were included in the introduction to this report.

Gordon McBean and Don Hogarth were of great assistance in the final stages of report preparation. Their advice, ongoing edits and media relations skills were very much appreciated.

Above all, I want to thank my core team, who dedicated many long hours! Peter Johnson provided advice, support and encouragement, which were influential in the organization and outcome of our workshop. We met by chance in an airport and as an Ivey grad, Peter jumped in with his usual good humour and expertise. He put the business team together, and without Peter this project could not have happened! Kevin Fitzgibbons provided timely and thoughtful advice throughout the entire project. Alison Ariss made an intelligent and energetic contribution in the preparation and organization of the workshop and provided editorial insight to this report. Thanks also to her colleague Dan Sinai for lending his support to Alison and to the workshop. Thank you to Guy Holburn for his valuable contributions as the key Ivey faculty member who assisted throughout. To Gillian Johnson, I extend my personal and sincere thanks for seeing this project to its completion. Her focus and sheer determination saw us through! So much for leadership by the next generation!

Thank you to everyone who believes that by working together we will advance a national agenda and contribute to the formulation and implementation of public policy.

Dianne Cunningham



IVEY

Sponsors

	Conseil de recherches en sciences humaines du Canada	Social Sciences and Humanities Research Council of Canada
---	--	---

	Natural Resources Canada	Ressources naturelles Canada
---	--------------------------	------------------------------

	Ontario Centres of Excellence Where Next Happens
---	---

	Ontario
---	---------


--


--


--

Richard Ivey School of Business The University of Western Ontario	
--	---






--

