
The Canadian Energy Challenge Workshop: An Engineering Perspective

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Executive Summary

The *Canadian Energy Challenge Workshop: an Engineering Perspective* took place on Friday, May 5, 2006 at the University of Ontario Institute of Technology (UOIT) in Oshawa, Ontario. This Workshop was sponsored by the Canadian Academy of Engineering, and its Steering Committee consisted of Carolyn Hansson, Clement Bowman, Philip Cockshutt and Gordon Slemon, chaired by Richard J. Marceau. Ms Donna Cansfield, Minister of Energy of Ontario, graciously accepted to be the Honorary Chair of the Workshop.

Over 70 influential Canadians in the energy area attended the one-day Workshop. Sessions concerning the Global Scene, the Canadian Energy Context, Energy Pathways, and Energy Policy Implications led to a consensus that our abundant and varied energy resources are not sufficient to maintain a leadership role for Canada in the energy area. Indeed, for Canada to become a *sustainable energy superpower*, Canadian government and industry must jointly develop a comprehensive and coherent energy policy, strengthen commitments to R&D, and accelerate the development a highly-qualified and well-trained workforce for the energy industry. The Canadian Academy of Engineering will continue its contribution to this discussion by identifying and exploring energy pathways that will maximize the benefits derived from energy resources for Canadians and the world.

Introduction

Energy is an essential foundation of Canadian Society and critical to our prosperity, security and environmental and social well-being. It is a major pillar of the economy, representing approximately 7% of Canada's GDP and \$50 billion in exports. The energy sector provides over 225,000 well-paying, skilled jobs. Canada has an energy intensive economy and the demand for energy and energy services (manufacturing, transportation, heating, lighting, etc.) continues to grow.

However, Canada is confronted with some major challenges. Canada needs to ensure access to clean, reliable and affordable sources of energy, while being sensitive to the impact on the environment (air quality, GHG emissions, etc.). To successfully address these issues, and many more, Canada needs a transformation of its energy economy. It requires sustainable development of Canada's diverse energy resources and responsible end-use of energy. In this regard, technology is recognized as essential to overcoming challenges and capturing opportunities in the energy economy.

The speakers who addressed these issues for the purpose of stimulating exchanges during the Workshop were as follows:

- Kathleen Sendall, Senior Vice-President, Petro-Canada and President, Canadian Academy of Engineering
- Murray Stewart, President, Energy Council of Canada
- Oskar Sigvaldason, Executive Advisor, Hatch Acres
- Angus Bruneau, Chairman, Fortis Inc.
- Robert Griesbach, Hatch Associates
- Clement Bowman, Canadian Academy of Engineering
- John Lowe, Director, Energy Policy Framework, NRCan
- Robert Mansell, Professor of Economics and managing Director of ISEEE, University of Calgary

Summary of Speakers' Key Messages

Background

Kathleen Sendall provided the backdrop for the workshop by highlighting the strong relationship between energy consumption and economic growth in Canada and worldwide. She pointed out that by the year 2030, it is expected the world's demand for energy will increase by 50% and that much of that increase will take place in developing countries. This is a daunting global task to ensure that supply will keep pace with demand.

Global Energy Scene

Murray Stewart and Oskar Sigvaldason led the session on the Global energy scenario. Using re-

cent data published by the World Energy Council (WEC) of which Canada is an active member, Dr. Stewart highlighted WEC's forecast of continued rapid growth in energy demand for fossil fuels, renewable sources and nuclear. To meet such demands, it was noted that the International Energy Agency (IEA) estimates that close to US \$17 trillion (cumulative) of energy infrastructure investment will be needed by the year 2030. In Canada and the United States, this amounts to US\$4 trillion (\$1.7 trillion for electricity; \$800 billion for natural gas; and \$600 billion for oil).

Oskar Sigvaldason gave a summary of an Energy Scenarios study that was recently commissioned by WEC. The study provided several areas where dominant global issues and opportunities exist. One interesting observation from that study showed that the greatest saving in energy consumption, if proper technologies and good practices are employed, is in the mobility sector. For Canada, he suggested that there is an urgent need to pick the "winners" among the different energy technologies. Whether this is hydrogen technology or fuel cells, Mr. Sigvaldason pointed out that the country must invest heavily in areas where the greatest potential are seen to exist or soon to be realized. He also pointed out to the very generous R&D tax incentives and encouraged the private sector to make good use of such incentives to boost their efforts in developing reliable, clean and sustainable integrated energy systems.

Canadian Energy Context

Angus Bruneau presented the Canadian energy context. At the outset, he made three very important observations:

1. Technology plays a central role when it comes to harnessing energy either directly from natural resources or through manipulation of such resources;
2. Materials by-products (resulting from manipulating energy sources) are the main

cause to global warming and not the other way around; and

3. As Canada and the world move towards environmentally-friendly energy systems, such systems become more technology-intensive than conventional systems.

Dr. Bruneau pointed out an alarming trend in funding for research and development in energy at both federal and provincial levels. He indicated that since the early 1980s, such funding has decreased by more than 50%. The private sector spends about 0.4% of its revenue on research related to energy. Dr. Bruneau sent a strong message that investment in research and development in energy must reflect its pivotal importance to the Canadian economy, and that Canada must improve its track record in getting technology out of the laboratory and into the market space. He called on Federal and Provincial governments to invest in technology, innovation and more importantly in people, these being the main drivers for new ideas and new technologies.

Dr. Bruneau encouraged the participants to use their best engineering practices to find the answers in new ideas leading to new technologies.

Energy Pathways

Robert Griesbach and Clement Bowman presented a progress report on the Academy's ongoing Energy Pathways Project. The objectives of the project are to identify and characterize the barriers to providing efficient, economical, and environmentally acceptable energy in a variety of areas, and to identify the different technologies that could conceivably overcome such barriers. The process was explained in terms of selection, postulation of challenges in each area, and then providing call-to-action statements by experts in the field. Examples of such pathways included clean coal to energy, wind, biomass, solar, hydrogen, nuclear, fossil fuels, and reduction of GHG

emissions [these are not complete pathways]. One of the motivations behind this work is to attempt to identify projects which could become high-priority Canadian initiatives in the near future.

Energy Policy Implications

John Lowe provided NRCan's perspective on energy policy implications - health, environmental and economical. He summarized the areas of policy implications in four main categories:

1. **Prosperity:** for Canada and the Canadian people;
2. **Security:** reducing reliance on foreign supply from politically unstable regions;
3. **Social sustainability:** paying attention to the problem of "energy poverty" that has become a social problem; for example, investigating opportunities in the area of aboriginal workforce to defray the labour shortage in this field.
4. **Environmental sustainability:** striving to reconcile our commitment to the environment with an energy-driven economic growth in Canada and worldwide.

He briefly summarized the existing federal energy policy, having also made the point that the new Federal Government has not yet officially announced any change in its position on energy. The present policy respects provincial authority; ensures that the public interest is protected and that energy supply and demand continues to be "market-driven". He pointed out that responding to the energy challenge will require cooperation among provinces and jurisdictions (while maintaining resource ownership within provincial boundaries). He also advocated increased intra-provincial trade and commerce and to have provinces jointly address environmental issues. Finally, he pointed out that a major constraint to growth in the energy sector is the shortage of skilled work force.

A New Vision for Canada

Dr. Robert Mansell summarized these presentations and proposed a compelling vision: *that Canada aim to become recognized as the first sustainable energy superpower!* Here are some of the highlights:

1. Energy means more to Canada than any other industrial nation: a high proportion of Canadian industry is energy intensive. Direct and indirect ties to energy are vital to the economy in Canada;
2. Canada presently exercises enviable leadership in key sectors of the world energy industry (e.g., oil sand petroleum extraction technology, hydroelectric power generation and transmission, nuclear power generation, etc.);
3. The key to energy today, and especially in the future, is technology; the key to technology is highly qualified personnel and a commitment to research and development; the key to highly qualified personnel is education, both in colleges and universities. It is unlikely that other nations will wish to invest in developing technologies that will benefit Canadians only;
4. Canada has the infrastructure and capability to develop “home grown” technologies through research, innovation and education. Thanks to this, Canada could choose to achieve *sustainable energy superpower* status;
5. Canada needs an appropriate policy environment to ensure that it achieves its long-term strategic vision.

Conclusion

Canada needs to develop innovative short- and long-term actions to address its energy challenges and maintain its present leadership in key sectors of the energy industry. However, Canada also has the capability and the resources to *become the world’s first sustainable energy superpower if it chooses to do so!* To achieve such a goal:

1. Provincial and Federal Governments must increase investment in research and development in the energy sector: this recognizes the fact that access to energy is first and foremost an issue of having access to the right technology. It also recognizes the fact that it is unlikely that other nations would be willing to develop technology that would primarily benefit Canada only;
2. Provincial and Federal Governments must also provide incentives to foster innovation: this recognizes the fact that Canada must improve its track record of getting technology out of the laboratory and into the market space;
3. An integrated approach to research, innovation, education and training must be adopted, and “piece-meal” solutions must be avoided. This recognizes the fact that access to technology is first and foremost an issue of having access to a highly qualified and well trained workforce, and that research and innovation can also be part of a learning strategy for providing appropriate skill sets to highly qualified personnel;
4. Provincial and Federal governments need to align their policies and collaborate further in order to reinforce this vision and implement it across the country.

As a final note, the Canadian Academy of Engineering will continue its Energy Pathways project in the hope of identifying projects which could become high-priority Canadian initiatives in the near future, thereby maximizing the benefits derived from our energy resources.

Acknowledgements

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