



The Canada-UK Colloquia

Energy

Security

Rapporteur's Report

Paul Boothe

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*Canada-United Kingdom Colloquium
16-18 November 2006, Chateau Lake Louise, Alberta*

School of Policy Studies, Queen's University
British Committee, Canada-UK Colloquia

The Canada-UK Colloquia

The Canada-UK Colloquia are annual conferences that aim to increase knowledge and to educate the public about the advantages of a close and dynamic relationship between Canada and the United Kingdom. These conferences take place alternately in each country, bringing together British and Canadian parliamentarians, public officials, academics, representatives from the private sector, graduate students, and others. The organizers focus on issues of immediate concern to both countries. One of the main endeavours is to stimulate and publish research in each subject under discussion. The publications listed at the end of the book demonstrate the wide range of topics covered by recent colloquia. The colloquia are supported by the Department of Foreign Affairs and International Trade in Canada and by the Foreign and Commonwealth Office in the United Kingdom. The conferences are organized by the School of Policy Studies at Queen's University on the Canadian side, and by the Canada-UK Colloquia Committee on the British side, from which an executive board, the Council of Management, is elected annually.

The first colloquium, attended by some sixty distinguished participants from both countries, was held at Cumberland Lodge in Windsor Great Park in 1971 to examine the bilateral relationship. This theme figured in the colloquium held at Leeds University in 1979, at Dalhousie University in 1984, and again at Queen's University in 1996. A British steering committee, later to become the British Committee, was launched in 1986. The School of Policy Studies assumed responsibility on the Canadian side in 1996, succeeding the Institute for Research on Public Policy. At the Denver Summit in June 1997, Prime Ministers Blair and Chrétien issued a joint declaration to mark a program of modernization in the bilateral relationship which included a role for the Canada-United Kingdom Colloquia. The program was reaffirmed during Mr. Chrétien's visit to the UK in 1998.

Reports on past colloquia may be found at www.Canada-UK.net.

Paul Boothe

Paul Boothe is Professor and Fellow of the Institute for Public Economics at the University of Alberta. He served as Deputy Minister of Finance and Secretary to Treasury Board for the Province of Saskatchewan for 1999-2001 and Associate Deputy Minister of Finance and G7 Deputy for Canada for 2004-2005. Dr. Boothe received his undergraduate training in economics at the University of Western Ontario and his doctoral degree from the University of British Columbia. Before joining the Economics Department at the University of Alberta in 1984, Dr. Boothe worked in the International Department of the Bank of Canada. He has held visiting positions at Queen's University, University of Tasmania, and Alberta Treasury and has served as an advisor or consultant to federal and provincial government departments and international agencies. Dr. Boothe has authored or edited more than seventy books, monographs and articles. His current research interests include fiscal relations between governments, government budgeting and public sector performance measurement.

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Preface

The question for this year's Canada-UK Colloquium on Energy Security was seemingly simple but extremely important: What are the risks for our energy security? We could think of no better place to discuss these challenging issues of economic growth and environmental protection than Alberta, one of the most important suppliers of energy in the world.

It is a pleasure to thank Paul Boothe, who served as Rapporteur and subsequently prepared this thoughtful and comprehensive report. We are especially grateful to Senator Hugh Segal for chairing two days of lively debate among a distinguished group of participants with his usual skill, tact and wit. The greatest credit must go to our advisors who helped devise the program: Joan MacNaughton on the UK side, and on the Canadian side, Dr Bryne Purchase in collaboration with Shane Pospisil, President of the Ontario Energy Association, and Ron Kneebone, Director of the Institute for Advanced Policy Research, University of Calgary.

The colloquium is only possible because of the assistance of Foreign Affairs and International Trade Canada and the UK Foreign and Commonwealth Office. This year's event also depends on support from the Institute for Advanced Policy Research, TransAlta Corporation, Natural Resources Canada, Croplife, AMEC plc, BP plc, Shell Canada, the Walter and Duncan Gordon Foundation, and Alberta Energy. We are deeply appreciative of their help.

The colloquium depends on the heroic efforts of small numbers of people. Special thanks go to George Edmonds-Brown, Executive Secretary of the Canada-UK British Committee, and Marlene Tullet of the Ontario Energy Association, for her exceptional logistical support. We are also grateful to the Canadian and British High Commissions for their continued assistance.

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Energy Security

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We live in a world where unprecedented affluence and grinding poverty coexist. In large measure, the affluence we enjoy is enabled by cheap energy and the freedom that it gives individuals from the day-to-day struggle of our ancestors. Likewise, in large measure, the poverty we see in the developing world is accompanied, and some would argue caused, by a shortage of energy that prevents people from satisfying even their most basic needs.

Our world is one where fossil fuels are the dominant source of cheap energy — although alternate sources of energy exist. These fossil fuels are not evenly distributed among countries and large imbalances between fossil fuels produced and consumed abound. Recently, the prices of some fossil fuels, particularly oil and natural gas, have risen substantially. Prices have become increasingly volatile, too. This volatility has increased uncertainty and raised concerns among the leaders of G8 countries about continued eco-

conomic growth in the face of further large, unpredictable increases in energy prices.

This colloquium was convened to unpack the issues around global energy security and to examine policy measures that could be implemented to mitigate the risks related to energy price and supply. From the outset, it became clear that it was not possible to separate the issue of energy security from its close counterpart, climate change. Indeed, the impacts of traditional methods of producing and consuming some kinds of oil and gas led to another kind of uncertainty related to climate change and potential environmental catastrophe. These environmental issues loomed large over the colloquium, permeating, and sometimes dominating, discussion in all sessions.

Although there was not agreement on all matters, some common trends emerged from the discussion. These related to the effects of political volatility in the Middle East and elsewhere, the urgency of the challenge of climate change, the part that innovation must play in finding solutions, the role of markets in searching out an efficient path forward, and the responsibility of governments to coordinate our activities and promote equity as well as efficiency.

GLOBAL ENERGY SUPPLY AND DEMAND

Given the location of our meeting in Canada's energy province, Alberta, and the preponderance of Canadian and British participants, it is perhaps natural that we began our discussion by focusing on the North American energy situation, dominated by the US, and then moved to the global picture. Markets for both oil and gas in North America are deeply integrated with Alberta supplying substantial quantities of fossil fuels both to the western half of the U.S as well as meeting much of Western Canadian and some Ontario demands. Canada is the top exporter of oil to the US, followed closely by Mexico. Venezuela, Nigeria and Saudi Arabia

round out the list of the top five foreign suppliers to the US. Participants immediately recognized the vulnerability of the US that stemmed from having three of its top five suppliers located in politically volatile parts of the globe, and this brought into sharp focus the importance that energy security plays in US politics and foreign relations.

Rick Hyndman's presentation drew the link between the US need for security of energy supply and the rapid development of Alberta's oil sands, with estimated reserves second only to Saudi Arabia. However, unlike in Saudi Arabia, exploitation of this energy source is relatively high cost and very emissions intensive with current technology, thus leading to an important tradeoff between the US making progress on energy security and North America making progress in combating climate change. But this occurs in a politically stable environment. A number of participants noted the value of conservation as one of the few strategic policy choices that addressed both energy security and climate change issues.

In turning the discussion to the global outlook, Bernard Bulkin observed that supply and demand factors could, in future, be working in opposition. Oil, and also natural gas supplies for Europe, are increasingly coming from politically volatile areas of the globe. Saudi Arabia, in particular, was identified as a supplier that could potentially undergo political dislocation, although other Middle Eastern and African suppliers are obviously vulnerable. In addition, new reserves are increasingly being extracted under evermore technically demanding conditions. For both of these reasons, we should view fossil fuel supplies as riskier in the future.

The growth of energy demand in the developing world, and in China and India in particular, is projected to be staggering. Potentially offsetting some of this growth, Bulkin argued that there remains a great deal of potential to reduce energy intensity in the developed world. In addition, there are signs that as late adopters, developing countries may be able to adopt energy conserving technologies quite quickly. With forces of supply and demand moving in opposite directions, the net effect on future energy prices is ambiguous. However, as participants noted, moving the globe to

an energy efficient/low carbon existence will be as much about changes in culture in the developed world as it is about prices and technological advances.

ECONOMIC RISKS

Understanding the nature of the economic risks related to energy volatility was an essential part of the colloquium. The discussion took place both at the level of an individual jurisdiction and at the global level. James Gilles laid out a scenario for the Ontario economy in which energy prices rose sharply from current levels to \$120 US per barrel. The result for Ontario was a significant drop in GDP, in the order of 2–3 years of normal growth, and a rise in inflation. GDP would fall as tourist and airline travel declined and the market for trucks and sport utility vehicles (a major output of the Ontario auto industry) collapsed. The extent of the decline would depend on the rapidity of the energy price increase and the speed at which the Ontario economy could adapt to the new, higher price of energy.

In Canada, such a decline would set in motion a number of government automatic stabilizers through transfers from the federal to provincial governments and transfers to individuals such as social assistance and the employment insurance program. However, it is unlikely that these programs, by themselves, could provide a sufficient level of stabilization in the short run. In addition, regional tensions in Canada could be greatly exacerbated as western provinces benefited from the oil price rise while central and some eastern provinces suffered.

The discussion of global impacts began with some history of past energy shocks and Paul Horsnell reminded the colloquium that a significant proportion of past disruptions have, in fact, been initiated by consumers rather than producers. He challenged the group with a question: Does our fear of energy market shocks stem from a failure of the market to efficiently price risk, i.e. a market

failure, or is it rather that we are simply dissatisfied with the equilibrium outcome as consumers of a suddenly more expensive commodity? The preponderant, although not unanimous view was that to date, markets had done a relatively good job of dealing with the uncertainty of world energy markets.

The discussion of energy market effectiveness and security led quickly to the parallel discussion of markets and emissions. The absence of (and pressing need for) well-functioning markets for carbon emissions was stressed repeatedly. One implication of such markets was higher energy prices in the future as the full cost of energy consumption (i.e. including the cost of emission permits) became incorporated into the price. However, this was deemed another instance where markets could be relied upon to contribute to a solution (in this case, for climate change) if they were allowed to develop and operate freely.

One of the interesting paradoxes that emerged from the discussion was that some actions that consumers could themselves take to mitigate risk might make private markets work less well. An example was governments in consuming countries embarking on large scale storage programs. Such programs might act to discourage private markets from financing the infrastructure investment that would provide alternate supplies in the event of a disruption occurring for a major supplier.

GEOPOLITICAL RISK

Political risks need to be considered both at the local and at the global level. Harvey Cenaiko spoke about Alberta's measures to protect its oil and gas production and transportation infrastructure from attack. In addition to physical measures to protect the actual sites, he emphasized two additional approaches, one by industry and another by government. In the case of industry, the development of redundancy in infrastructure was emphasized, so that any single attack would not disable the energy transportation

system for a long period. In the case of government, general surveillance of criminal and terrorist threats with a view to prevention of attacks was needed. Here, the benefits of cooperation and information sharing among law enforcement agencies both within Canada and internationally were stressed.

Discussions of potential global threats are necessarily gloomy given the political volatility that plagues some of the world's major producing regions and transportation routes. Energy security is becoming both a tool and a goal of major powers' foreign policies. For example, access to energy is being used increasingly by Russia as a tool to achieve goals related to its former satellites. The importance of Russian gas to Europe has been highlighted by the dispute with Belarus in which Russia stopped shipments through that country that were destined for Europe. China has made acquisition of energy assets and the signing of long term contracts in the developing world a priority. Sometimes such links have been forged with countries with poor human rights records.

No discussion of the geopolitical dimensions of energy security can ignore the Middle East. Prospects of Iraq regaining its importance as a major supplier are dimming as the security situation in the country worsens and prospects for reconstruction fade. Iran's conflict with the West over its nuclear policy is particularly worrisome — both because of the consequences of Iran developing nuclear weapons capability and because of the importance of Iranian oil to world markets. With forty percent of the world's oil flowing through the Strait of Hormuz, the strategic position of Iran cannot be over-emphasized.

Political uncertainty, however, is not confined to the Middle East or former members of the Soviet Union. Major African suppliers such as Nigeria are experiencing significant disruptions as a result of local unrest. As well, Latin American suppliers such as Venezuela and Ecuador are assuming aggressive anti-American postures and moving to nationalize private sector firms exploiting their energy resources. More than eighty percent of known reserves are now in the hands of national oil companies, making

the influence of political as well as market forces increasingly important.

In addition to enumerating the geopolitical risks to energy security, we need to develop strategies to mitigate them. If energy self-sufficiency is not a viable strategy for the US or Europe, then engagement with energy producers is the only realistic approach. Together with vigilance against terrorist attacks and efforts to reduce fossil fuel dependence, engagement with producing countries provides the best hope for managing geopolitical risks to energy security in the future.

ENVIRONMENTAL RISKS

Although there is clear evidence that awareness of climate change and the seriousness of the challenge we face is growing, it is worth remembering that it is by no means a new issue. David Keith underlined his frustration with the pace of action on climate change by reminding us that Senator (later President) Lyndon Johnson was warned by scientists of the problem as early as 1956. Everywhere we go, we should stop and think about the profound environmental changes that are in progress. For Lake Louise in the Canadian Rocky Mountains it is the rapid melting of the glaciers. For London, England, it is the rising of the sea. We know that these changes will, in turn, bring about massive changes in the way our children and grandchildren live their lives. Tens and perhaps hundreds of millions of people will be displaced as sea levels rise. The nature of flora and fauna and agriculture in vast regions of the globe will change. Some people will be made better off by climate change, but for many more, circumstances will worsen.

A number of potential tradeoffs exist between climate change and energy security. For example, non-conventional energy sources such as the oil sands or oil from shale increase energy self-sufficiency and therefore energy security for some countries, but production of these fuels creates more emissions

than conventional fuels and thus accelerates climate change. Increased use of nuclear energy reduces emissions but may compromise security by increasing the risk of the proliferation of nuclear weapons. The complexity of the tradeoffs and the unpredictability of technological change suggest that our policy response should be based on transparent, economy-wide measures like carbon pricing that allow markets to find the best ways to accomplish both our energy security and environmental goals.

Who will be first to introduce such policies? In North America, Canada ratified the Kyoto Protocol, but has made no progress towards meeting its targets. The Conservative government that came to power in 2006 has admitted there is no possibility of meeting the targets on schedule. The US did not ratify, but is slowly moving forward and may become a leader. California, with its enormous market, has the capacity to lead policy change. California has set the pace on world vehicle emission standards. Proposed legislation will force suppliers of energy to California to adopt its emission standards — potentially driving massive change in the integrated North American energy market.

Clive Mather underlined the adaptability of the energy industry with a recent example. When, as a result of US hurricanes, fifteen refineries were put out of commission, industry responded to avoid any serious disruption of supply. Despite expressing some displeasure at the time, consumers coped very well with \$70 oil. Indeed, it may be that in North America, the most serious threat to energy security is corrosion, not terrorism. Some of the North America's energy infrastructure is very old and expensive and difficult to replace in the current regulatory environment.

One question that emerged repeatedly in the discussion is what role new technology will play in dealing with the environmental challenges related to energy. A number of existing technologies could be used to make substantial progress on reducing emissions, but carbon must be priced for these technologies to be economical. Such technologies include carbon capture and storage, renewables such as wind power, solar, and small-scale hydro.

Emerging technologies, including cellulose-based biofuels and clean coal need to be encouraged by government.

Another interesting question is how much should we look to changes in human behaviour to reduce emissions? Behavioural changes could include how we travel about our cities, the design of our dwellings, even the food we eat. Awareness of the magnitude of the challenge and the need to change are growing, especially among the young. This is not to say we must abandon the benefits of an industrial society. However, the way we go about our daily lives will likely change profoundly in the next couple of decades. What we do not yet know is whether those changes will be brought about by the need to adapt to accelerating climate change or as a result of actions we took to reduce carbon emissions and dramatically slow humanity's contribution to global warming.

THE ROLE OF NUCLEAR POWER AND RENEWABLE ENERGY

One of the most important existing low-emission technologies is nuclear energy. Despite its track record in terms of safety and performance, many people in developed countries are uneasy about expanded use of nuclear. Further, while nuclear reactors are being built in some developing countries, the link between nuclear technology and the proliferation of nuclear weapons is a cause for concern.

Duncan Hawthorne outlined some of the challenges and opportunities for nuclear energy in the future. One major challenge is the age of existing infrastructure. Not only is the infrastructure aging, but the pool of skills required to design, build and operate nuclear facilities is shrinking as nuclear engineers retire without being replaced. The aging of both physical and human capital will continue until we restart our nuclear-facilities building pro-

gram. The regulatory processes' long lead times from concept to commissioning makes this challenge even more acute.

However, advances in nuclear energy technology present some attractive opportunities. The next generation of reactors can improve the performance of the industry substantially in terms of cost, complexity, and safety. However, the industry will need to build some of the new plants to prove it. One area of technology that remains a challenge is the development of nuclear weapons proliferation-resistant reactors. At this stage, such technology appears to remain far in the future.

Much of the responsibility for overcoming public apprehension about nuclear energy lies with the industry. Indeed, in countries like France, nuclear is the predominant and widely accepted energy source. However, it is incumbent on the industry to inform the public about their safety and performance records and to address the concerns of local populations.

Governments also have a role to play if nuclear energy is to form an important part of our future energy portfolio. Nuclear energy is a low-emission source of base load power, but it is not flexible like coal and has high new capacity costs. Government will have to reduce market risk by providing long-term contracts or price floors to encourage the large investments needed. What government should not do is assume industry's construction or operating risk.

It is easy and probably dangerous when discussing the impact that low-emission technologies like nuclear and renewables can have on reducing emissions to forget that they all have to be factored into a growing demand for energy — especially from rapidly industrializing countries such as China and India. Jon Gibbins tempered the optimism surrounding the impact of these technologies by showing how they all fit into the International Energy Agency's *World Energy Outlook* (WEO). Overall, the picture painted in WEO is a pessimistic one. Even in the WEO alternate scenario, fairly aggressive action on emissions by developed countries is overwhelmed by the combination of rapidly increasing energy

intensity of developing countries' economies and the technical barriers to reducing emissions substantially in key sectors like transportation.

If the WEO is approximately correct about the future path of emissions, the implication is that countries need to put a lot more effort into adaptation, because substantial climate change is inevitable by, say, 2030. As James Lovelock argues in *The Revenge of Gaia*, assuming we are already past the tipping point on global warming, governments must first ensure that we have safe and secure forms of energy to sustain our technologically based civilization as we adapt to rising sea levels and other consequences of climate change. In Lovelock's view, only a substantial investment in already-proven nuclear energy will sustain society through to a post-climate-change world.

Whether one is an optimist or a pessimist, it seems clear that we need a "portfolio approach" to nuclear energy and renewables like biofuels, in part because no one can predict what will be the next big thing. It is also clear that timing matters, i.e. some things such as wind farms and biofuel plants can be brought on relatively quickly while others, like new nuclear facilities, take quite a long time. These differences suggest that governments need to think ahead about how to get the timing right. Finally, even with a plan to develop a diversified portfolio of low-emission energy projects, commitments must be made now if we are to begin reducing emissions, and, if you are a pessimist, if we are to sustain society in the post-climate-change future.

THE ROLE OF POLICY

What role should public policy play in dealing with the twin challenges of energy security and climate change? These challenges are global collective action problems and we need to recognize that existing multilateral institutions are probably inadequate to the task. Some new institutions are evolving. An example is the

G8 dialogue at Gleneagles and St. Petersburg with the emerging leaders in the developing world, including China, India, Brazil, and South Africa. Another is the G20 forum of finance ministers that includes many major consumers and producers. In addition, the Joint Oil Data Initiative has almost 100 participating countries and shows promise for increased transparency. However, more needs to be done. For example, the need for a global emissions trading system is pressing, but how will countries cooperate to make it a reality? Of increasing importance in the future will be international cooperation on adaptation.

Policy challenges are not confined to the multi-lateral stage. Mel Cappe observed that the challenges for federal states may be even greater than those faced by unitary ones. In Canada, the federal government is empowered to enter into international treaties, but in many cases, the provinces are required to implement them. When provincial interests differ, for example when energy resources and emissions are distributed unevenly across regions, a complex negotiation is required to move to collective action. In Canada, the federal government has, so far, been unwilling or unable to take the lead in building that consensus to develop truly national energy and environmental policies. Certainly, part of building the consensus necessary for collective action within a country is for government to develop mechanisms that are seen to share the burden of adjustment fairly across regions and groups in society.

However, sub-national governments may also be leaders in developing and implementing solutions to the twin challenges. In the past, California, not the US federal government, has set the pace in emission reductions in automobiles. Current proposals to use California's market power to reduce the emissions of its electricity supplies bears close scrutiny.

Although markets are seen as key to developing efficient responses to the twin challenges, by their nature, they are only part of the solution. At the global level, governments must also play their traditional role of ensuring equity as we grapple with problems of energy security and climate change. Equity is a prerequi-

site for consent, and nowhere will this be more important than in the developing world. This imperative applies not only to the emerging leaders of the developing world, but also to the poorest countries who are currently impoverished in energy and likely to face some of the most drastic impacts of climate change. One critical equity question to be answered is this: On what terms is the developed world willing to share technological advances in the areas of clean energy with developing countries?

Joan MacNaughton underlined the need for leadership by elected representatives, by which she meant consistently confronting the public with the unvarnished truth about the challenges we face, the possible solutions along with their benefits and limitations, and measures of progress. To do this, a high degree of transparency will be required. Proposed solutions will need to be subject to public critique, both to make the best choices and to build public awareness. These are complex matters, and the risk of oversimplification is great. Yet oversimplification will result in poor choices among policy actions.

CONCLUSIONS

Obviously, no solution to the twin challenges of energy security and climate change can be found in a single colloquium. However, over the course of the two days of discussion, five themes emerged. The first is that conservation is the single most effective strategy to meet these two challenges. While it is only part of the answer, it is an important part and will require changes to way we in the developed world go about our daily lives. These changes will only come about if we face different incentives. The price of energy should include the full cost of using it, i.e. take full account of the emissions created in producing and consuming it.

A second theme is that different technologies, both existing technologies like nuclear and wind power, and emerging technologies like solar power, biofuels, and low emission vehicles, will

be increasingly important in the future. Governments have an important role to play in creating incentives by ensuring that the full price of energy is charged, in underwriting basic science, and in clearing away unneeded regulatory barriers to adoption.

Even if conservation and improved technology are successful, it is clear that complete energy self-sufficiency is not a realistic goal for most major countries in either the developed or the developing world. With much of the world's fossil fuels coming from politically volatile parts of the globe, a third theme is that engagement between consumer and producer countries will be critical. Existing institutions are not sufficient. New institutions are developing and much work will be needed by all countries to make them effective in addressing the twin challenges of energy security and climate change.

Markets are an extremely powerful tool that can be harnessed to help us deal with the twin challenges. But both energy security and the global climate are public goods, so governments must act to create the needed markets. The pressing need for a global trading system for carbon is a fourth theme, but this should come from building upon regional markets like the one that is emerging in Europe. Once created, markets need to operate freely if their full benefit is to be felt, and governments must resist the temptation to interfere in markets to try to accomplish other policy goals. Markets thrive on information, and here governments can help perfect markets by promoting the collection and free dissemination of information regarding energy supplies and technology.

A final theme is related to equity. Dealing with the twin challenges of energy security and climate change will inevitably create winners and losers around the globe. As one participant put it, equity is a prerequisite to consent. The compensation of those negatively affected by measures to meet the twin challenges will be critical, as will helping those who must adapt to rising sea levels and other climatic changes. The costs of developing and distributing new technologies must likewise be shared equitably.

Are we, as a civilization, up to the twin challenges of energy security and climate change? No one can say for sure. From our discussion, we know that solutions are possible — if we have the courage and determination to embrace them.

Appendix: Opportunities for Joint Canada-UK Action by Colloquium Participants

- Communicate forcefully with political leaders at home and abroad regarding the urgency of addressing the twin challenges.
- Encourage the use of global forums like the G8 and G20 to engage with other energy producers and consumers to develop and implement plans for action.
- Support the development of a global carbon trading system.
- Encourage joint Canada-UK work on the development of “next generation” nuclear energy.
- Develop mechanisms for sharing emerging energy technologies with developing countries.
- Work jointly on strategies for adapting to climate change.

PROGRAM

Energy Security: The 2006 Canada-UK Colloquium

Session 1: Global Energy Supply/Demand: A Risk Profile Overview

Canada: Rick Hyndman, Canadian Association of Petroleum Producers
UK: Bernard J Bulkin, UK Sustainable Development Commission

Session 2: Energy Security: Economic Risks

Canada: James Gillis, Deputy Minister, Ontario Ministry of Energy
UK: Paul Horsnell, Managing Director, Barclays Capital

Session 3: Energy Security: Geopolitical Risks

Canada: Harvey Cenaiko, Alberta Solicitor General and Minister of Public Security
UK: Stuart Brooks, Policy Co-ordinator, Government and Public Affairs, Chevron Ltd.

Session 4: Energy Security and Environmental Risk: Fossil Fuels and a Lower Carbon Society

Canada: David Keith, Professor, Departments of Engineering & Economics, University of Calgary
UK: Clive Mather, President and Chief Executive Officer, Shell Canada Limited

Session 5: Energy Security: Nuclear Power, Renewable Energy, Conservation and a Lower Carbon Society

Canada: Duncan Hawthorne, President and CEO, Bruce Power

UK: Jon Gibbins, Imperial College, London

Session 6: Policies to Enhance Energy Security: Next Steps?

Canada: Mel Cappe, President, Institute for Research on Public Policy

UK: Joan MacNaughton, Director General International Security, Department of Trade and Industry

Session 7: Rapporteur's Report

Rapporteur: Paul Boothe, Professor of Economics, University of Alberta

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