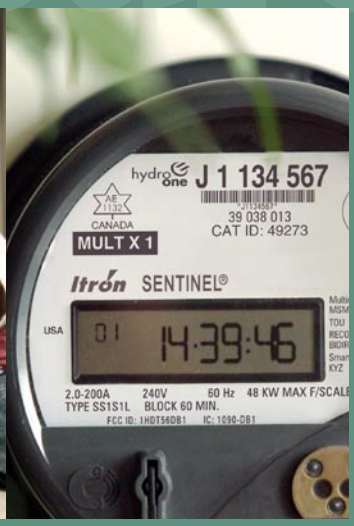
National Energy Board | Office national de l'énergie

Canada's Energy Future

CONSUMER RESPONSE TO HIGH ENERGY PRICES PANEL DISCUSSION



STAKEHOLDER INPUT 2006

Canada

2007 Energy Futures Speaker Series:
Consumer Response to High Energy Prices
Panel Discussion

21 April 2006
National Energy Board Hearing Room
2nd floor, 444 7th Ave SW, Calgary Alberta
8:30am – 12:30pm

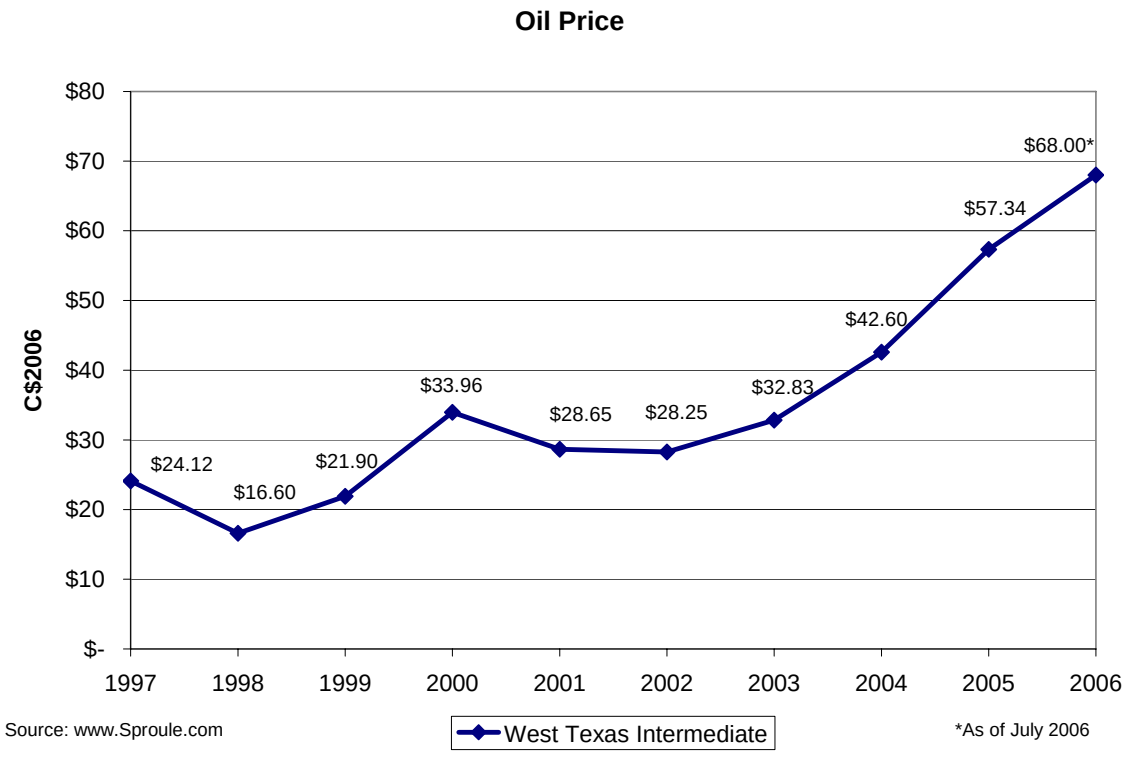
Table of Contents

Cover photos
Images courtesy of Canadian Pacific Railway and Hydro One

Background

The National Energy Board (NEB or the Board) periodically publishes a long-term outlook for energy supply and demand in Canada. The Board has embarked on its next Energy Futures report, which is scheduled for release in the fall of 2007. The key objectives of this report are to provide a comprehensive analysis of Canadian energy markets and to provide a framework for public discussion on emerging issues and trends. As part of the report, the NEB seeks input from various stakeholders on areas of interest.

A key uncertainty that the Board wanted to explore was consumer response to high energy prices. Energy prices have been rapidly increasing over the last few years as depicted in the chart below. This has given rise to questions about how consumers are going to respond to prices that are much higher than they have been in the recent past.



The general observation is energy demand response has been slow, although some leading indicators have suggested consumers might be responding to higher energy prices; for example, there has been a reduction in SUV and light trucks sales in Canada. Exact analysis of this issue is constrained by the availability of adequate data to perform analysis and draw reasonable conclusions. The last year for which energy use data is available in its full form is 2004 with the 2005 update not yet available. Therefore, an innovative approach was necessary to help understand how energy demand would evolve in this higher price environment.

The NEB sought the participation of six energy demand experts to take part in a Panel Discussion. The theme of the Panel Discussion was "*Why will energy demand in the next 10 years be any different than the last 10?"* Alison Bailie from the Pembina Institute, Jean-Thomas Bernard from Laval University, Nick Fulford from Direct Energy, John Nyboer from the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) at Simon Fraser University, Nicola Pochettino from the International Energy Agency (IEA) and Daniel Violette from Summit Blue Consulting each agreed to give a presentation on their individual areas of expertise. The Panel Discussion was facilitated by Dr. Judith Dwarkin, Chief Economist for the Ross Smith Energy Group. A detailed biography on each of these individuals can be found at the end of the report.

The purpose of this summary document is to share insights gleaned from this notable group with as broad an audience as possible. Included below is a discussion of key overarching messages of the event, individual summaries of each presentation and resulting discussions, as well as a copy of the presentations. The summaries and presentations are in the order in which the experts presented during the Panel Discussion.

The information from these experts will be incorporated into the Board's development of the 2007 Energy Futures Report.

The Board would like to take this opportunity to again thank the facilitator, Judith Dwarkin of Ross Smith Energy Group Ltd., and our very distinguished speakers for the time and effort dedicated to helping make this session a success. Your information and insight have increased the Board's understanding of energy demand issues. As well, it is our belief that your efforts have made an important contribution to encouraging the energy debate among interested stakeholders in Canada.

Key Messages

The Panel Discussion on Consumer Response to High Energy Prices highlighted a number of energy demand issues. The focus of the following section is to summarize the key themes and messages present in many of the speakers' presentations and the resulting question and answer period.

1. The Importance of Energy Pricing

A necessary requirement for efficient energy markets is the development of a market structure that truly enables appropriate decision making on both the supply and demand side. This can be achieved by setting energy prices to reflect the true cost of supply. It is expected that higher prices will decrease energy demand and promote additional investment in supply. Alternatively, low prices encourage demand and reduce supply. This price mechanism ensures that supply and demand balance.

Debate surrounding appropriate energy pricing strategies abounds. This is particularly true for the electricity sector where prices are not transparent. Price signals reflecting supply costs provide incentives to manage on-peak electricity demand. The ability of consumers to respond to these price signals result in more efficient resource allocation in the market. Smart meter technology and time-of-use tariffs can facilitate the development of appropriate electricity pricing.

In Canada, the current oil and gas energy price environment could result in pressure on governments to introduce energy rebates and subsidies to cushion the impact of high prices to consumers. These types of policies reduce the incentive to manage energy demand and reduce the effectiveness of markets.

2. Income Effect versus Price Effect

The empirical evidence suggests that the effect of higher incomes (the income effect) surpasses the effect of higher prices (the price effect). As consumers become wealthier, they invest in new energy demand services and so despite the unit efficiency of energy devices improving over time, absolute energy demand is actually increasing. For example, despite improvements in more traditional household energy using equipment, such as furnaces and appliances, overall residential energy demand has increased due to other energy-using goods and services, which could include new goods such as patio heaters and driveway deicers.

This is true not only in Canada but also in a global context. Continued economic growth in rapidly developing countries is expected to lead to increased demand for energy-using goods and services, such as personal vehicles, despite higher energy prices than have been experienced in the recent past.

3. The Need for Government Policy

The recent increase in energy prices is due in part to rapid global energy demand growth. These higher prices contribute to energy poverty in Canada disproportionately impacting low income Canadians who bear a high energy cost burden as a percentage of their income. In addition, energy demand growth contributes to rising concerns about climate change and energy security. Energy supply sources are increasingly becoming more concentrated away from major demand centres. Government could manage these effects through energy demand policies, such as energy efficiency programs, smart meters and time-of-use pricing, incentives to encourage innovation and demand side management, a greenhouse gas emission cap-and-trade program, or transportation fuel efficiency standards.

To be effective, government programs will need to be designed for the long-term and revisited frequently to create the appropriate incentives to manage demand. Further, government programs should incorporate program monitoring and evaluation to ensure expected benefits are realized. This requires comprehensive data collection on energy demand and equipment prior to and after program implementation.

4. Energy Efficiency Challenges

Energy efficiency improvements occur naturally as older inefficient equipment and processes are replaced by new equipment and advancements in technologies. However, more rapid adoption of energy efficient technologies are often said to be "economic", meaning the additional capital cost of the energy efficient equipment is earned back in energy cost savings over the lifetime of the equipment or over a predetermined payback period. In the market, these more rapid energy efficiency improvements do not take place which suggests that there are barriers to their adoption.

Many potential barriers have been identified. Energy efficiency improvements could be too complicated and time consuming for consumers to adopt. The upfront cost of the energy efficient equipment might deter consumers from investing despite the return on investment over the lifetime of the equipment. This could be especially true for low income earners, who struggle to simply warm their homes. Alternatively, energy efficiency improvements could compete with numerous other home and business upgrades for limited consumers' attention.

These barriers also make it more difficult to successfully implement energy efficiency programs. To create good programs, it is critical to get this issue on the minds of consumers, which takes significant time and effort. Long-lived programs should be designed to ensure energy efficiency goals are achieved, and program evaluation and verification should also be incorporated.

5. Demand Data Constraints

In recent years, understanding energy demand trends has become more important. The result has been increased scrutiny of energy demand data leading to demand data reliability questions. In the industrial sector, a significant amount of work has gone into re-estimating historical industrial demand trends from the year 1990 forward. Despite best efforts, some gaps remain; for example, there is still relatively inadequate data on upstream oil and gas energy demand. Further, the release of energy demand data significantly lags actual events, making timely inferences about current market trends difficult.

Speaker Summaries

Nicola Pochettino: Energy Demand in New International Markets

International Energy Agency (IEA)

Mr. Pochettino from the International Energy Agency (IEA) was invited to provide insights on energy demand developments in the international community focusing on energy demand growth in rapidly developing countries such as China and India.

The IEA publishes a World Energy Outlook (WEO) every year. This outlook evaluates global market trends and forecasts energy production and use over the next 25 years. Mr. Pochettino shared results from the IEA's 2005 Reference Scenario and Alternative Policy Scenario. The reference case assumes no change in energy policies over the forecast period, whereas the Alternative Policy Scenario analyzes the impact of countries enacting changes in energy policies to curb energy demand. The 2006 WEO is scheduled for release in November 2006.

In the 2005 WEO, real energy prices are forecasted to fall from the current high levels over the next five to six years. This expectation is based on the IEA's belief that energy demand growth will slow in the face of high energy prices and that there will be sufficient supply developed to meet global demand as upstream and downstream projects are completed.

In the Reference Scenario, global energy demand is expected to increase over the next 25 years from roughly 10.7 billion tonnes of oil equivalent (toe) to 13.4 billion toe in 2015, and 16.1 billion toe in 2030. Not all fuels will contribute equally to growth. Assuming no change in energy policies, hydro and nuclear energy will remain relatively flat and much of the growth in energy demand will be supplied by fossil fuels. In fact, oil, gas and coal are expected to account for 83 per cent of the growth by 2015. Oil will remain the largest contributor to global energy demand. Today, global oil consumption is approximately 84 billion barrels of oil. This is forecasted to increase to roughly 100 billion barrels by 2015 and 115 billion barrels by 2030.

The IEA expects to see the developing world increase its share of global primary energy demand over the forecast period. In 1995, the Organization for Economic Cooperation and Development (OECD) countries accounted for more than half of the energy use in the world (53 per cent), but by 2015 they are expected to account for less than half (46 per cent). About 60 per cent of the increase in world energy demand between 2003 and 2015 will come from developing countries and the bulk of this growth will be from Asia.

Carbon dioxide (CO_2) emissions are also expected to increase. Today, the world is producing approximately 24 gigatonnes of CO_2 and this is expected to increase to 34 gigatonnes by 2015. OECD countries and China CO_2 emissions are expected to increase

at the same rate; however, on a per capita basis, OECD countries CO_2 emissions will still be three times higher in 2015.

Most of the increase in oil demand is expected to come from the transportation sector. The significant growth in this sector is because there is currently no readily available substitute for oil and no significant energy policies in place to curb energy consumption. The scope of global transportation oil demand to increase is huge. There are 770 cars per 1000 inhabitants in North America and 500 cars per 1,000 inhabitants in Europe. Currently, in China there are only 13 cars per 1,000 inhabitants. Assuming generous growth rates by 2015, this is expected to more than double to 33 cars per 1,000 inhabitants. The potential for more growth in the future is staggering.

Oil and gas supplies are increasingly being concentrated away from large energy demand centres giving rise to security of supply concerns. This is true also in rapidly developing countries. By 2030, over 74 per cent of oil demand in China will be imported and India's oil imports will more than double. Gas imports in both of these countries are expected to rapidly increase so that by 2030, China will import almost a quarter of their gas demand and India almost 40 per cent.

Electricity generation capacity in China and India are expected to rapidly increase over the forecast. Roughly, 1,100 GW of capacity is expected to be installed. This is more than the currently installed capacities of Canada and the U.S. combined.

The IEA is of the opinion that this level of energy demand growth is unsustainable. To examine a more sustainable future, the IEA considered an Alternative Policy Scenario, where energy demand management policies under consideration in OECD countries are enacted, and non-OECD countries benefit from more rapid knowledge and technological transfers from OECD countries. As a result, by 2030, the incremental increase in fossil fuel energy demand is mitigated. Oil demand is expected to be 12.1 million barrels per day less than in the reference case. Gas demand is forecast to be 500 billion cubic meters lower. Coal is expected to be 1,682 megatonnes smaller. This amounts to a 10 per cent reduction in oil and gas demand in the Alternative Policy Scenario compared to the Reference Case Scenario by 2030 and a much larger reduction for coal use, especially in the power sector. However, fossil fuels will continue to dominate the global supply mix.

The majority of the fossil fuel energy demand reductions occur because of improvements in energy efficiency: 20 per cent are due to an uptake in renewables, 10 per cent are from nuclear and the remaining 12 per cent are due to fuel switching in power generation sector and in end-use technologies. These trends vary by region. For instance, OECD countries are less able to benefit from energy efficiency improvements than developing countries.

Significant investments are required to adopt more efficient systems and technologies. For example, the estimated investment required on the demand side for the electricity sector is $700 billion. This large investment will be offset by avoided supply side

investments, such as investment in generation, transmission and distribution resulting in a net cost savings.

By holding current world energy policies constant, energy demand will increase substantially and fossil fuels will continue to dominate the energy mix. This raises concerns about increased vulnerability to supply disruptions, increasing CO_2 emissions and massive energy investment needs. Government action could curb the increase in energy demand and emissions significantly. Key alternative policies include more rapid adoption of energy efficiency improvements, increased share of nuclear, implementation of clean coal and renewables, as well as, promotion of advanced energy technologies.

John Nyboer: Canadian Industry Energy Demand: The Next 10 Years

Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC)

Dr. Nyboer from the Canadian Industrial Energy End-Use Data and Analysis Centre (CIEEDAC) was invited to share his insights on future industrial energy trends in Canada.

Over the last 10 years, industrial energy demand has been volatile as a result of energy price spikes, technological developments, and structural changes in the economy. These factors, in combination with challenging historical energy demand data, have made difficult inferences about industrial energy demand trends. Regardless, a number of trends identified suggest increasing energy demand in the industrial sector over the next 10 years.

Rapid economic growth around the world is stimulating Canadian commodity exports in energy intensive industries, such as in upstream oil and gas mining. As a result, energy intensive industries in Canada are growing rapidly and energy demand in the industrial sector is rising. Similarly, the peaking of conventional energy resources in some places around the world means that unconventional resources will be more heavily relied upon. In Canada, this means further reliance on oil sands development, which is more energy intensive to extract and refine than conventional energy sources. This implies higher industrial energy demand than in the past.

The energy intensity of electricity is rising as we depend less on hydro and nuclear and more on secondary sources such as fossil fuels. In recent years, electricity overtook natural gas to become the highest used fuel in the industrial sector and the forecast for electricity consumption is expected to increase as industries become more digitalized. The combination of increased demand for electricity and the higher energy intensity of electricity generation are expected to increase industrial energy demand in Canada.

The impact of higher energy prices is less certain as they can cause both downward and upward pressure on Canadian industrial energy demand and greenhouse gas emissions. Higher energy prices spur additional energy efficiency improvements and the resulting rebound effect associated with these improvements will likely be small, as higher costs dissuade consumers from increasing energy use. Higher energy prices could also result in pressure on government to introduce rebates or subsidies to shield consumers from higher prices, which will erode consumer incentives to manage energy demand. These prices also stimulate investment in the energy sector, further increasing demand. Correspondingly, changes in the relative prices of fuels can lead to fuel switching and investment in alternative sources of energy (e.g., renewables). Depending on the relative changes in fuel prices, the outcome could be the adoption of more carbon intensive energy sources (e.g., coal becomes preferred if it is much less expensive than natural gas). These changes could have a positive or negative impact on greenhouse gas emissions in Canada.

Dr. Nyboer and his associates have estimated long-term elasticities in an attempt to shed light on industrial energy demand response to higher energy prices in Canada. Not surprisingly, they found the ability of Canadian industries to respond to higher energy prices varies across industry type, with some industries being quite sensitive to prices and others less so. They also found that the potential for fuel switching in the long-term is high. For example, industries can respond to relative price changes by moving from one type of fuel to another.

Ambiguity surrounding the types of environmental programs and regulations to be implemented creates uncertainty in future industrial energy demand. Adoption of technologies such as carbon capture and sequestration is likely to increase industrial energy demand as it takes additional resources to manage and transport carbon dioxide. However, a cap-and-trade program could reduce industrial energy use as it provides additional incentive for industries to manage demand.

Putting all of these factors together, Dr. Nyboer concludes that Canadian industrial energy demand is likely to increase over the next 10 years. If environmental policies are pursued, then industrial energy demand could be slowed and greenhouse gas emissions decreased. However, if environmental policies are not pursued, then industrial energy demand and greenhouse gas emissions will increase significantly.

Nick Fulford: Residential Electricity and Natural Gas Trends

Direct Energy

Mr. Fulford from Direct Energy was invited to provide his views on future energy demand trends in the residential sector.

Rising energy prices have made home heating a "top of mind" issue for consumers. This is significantly different from the usual dormant place on the typical homeowner's list of priorities. Increased prices have lead to an observed change in consuming behaviours although uncertainty about whether or not these changes are temporary or permanent remains. The future of residential energy demand trends are influenced by a number of factors, including government response, changing demographics and technological developments.

Over the longer term, it is expected that energy prices will continue to increase, resulting in concern over consumers' ability to meet energy needs, particularly the "fuel poor" who are low-income consumers spending a significant amount of their pre-tax income on energy. In North America, pressure to subsidize energy prices could reduce consumers' incentives to manage demand. In Europe, the policy focus is on long-term energy efficiency and conservation policies, which will result in residential energy demand management improvements. A possible reason for the marked difference in policy response between these regions is due to energy attitudes. North Americans are accustomed to having abundant, cheap and local energy sources whereas continental European countries are accustomed to depending on imports.

Changing demographics are likely to play a significant role in energy demand decisions in the future. Homeowners of the future will have radically different values from homeowners of today because they will have grown up in an environment that emphasizes climate change, sustainability and responsible use of resources. However, continuation of the trend toward single dwelling residences could counteract much of the benefits from value changes.

Homeowners of the future will also have grown up in the digital age and are likely to want to use technology to control and manage household energy demand. This is already leading to the development of many internet-enabled devices, such as appliances.

The foundation of the ability to exert digital control over household energy use is the smart meter. The smart meter provides customers full visibility of their energy usage, allows time-of-use tariffs to be introduced so consumers can change their energy use patterns to suit their budgets, and can facilitate the development and use of micro-generation, geothermal, solar and other technologies by keeping track of imported and self-generated energy.

Mr. Fulford presented learnings from a pilot project in California that combined smart meter technology with time-of-use pricing. The findings suggest that residential customers will trade in comfort to achieve savings on their energy bills. Interestingly, when asked, participants said that recognition for being part of a socially-responsible program was almost as important to their behaviour changes as achieving savings on their energy bills.

Average electricity savings per household was between1.5 and 3 kilowatts. In a typical city, this would represent enough energy savings to offset a sizeable peaking facility. So after almost 100 years of no change in the utility industry, a revolution could occur. The idea of "negawatts" facilitated by smart meter technologies and time-of-use tariffs could become mainstream resulting in technological advancements driving significant energy savings.

Over the next couple of decades, residential energy demand is expected to increase, but rising energy prices, more environmentally-aware homeowners and technological advancements are expected to mitigate this trend.

Jean–Thomas Bernard: Energy Demand Elasticities: Empirical Results for Quebec

Laval University

Dr. Bernard from Laval University was invited to share his work on Quebec energy demand trends. The main topic of Dr. Bernard's talk focused on short and long-term income elasticities, but he also shared some of his views on the energy pricing debate taking place in Quebec.

Energy is a derived demand. Consumers do not use energy for the sake of using energy, but rather to fuel equipment that provide other services, such as heating, lighting and transportation. Often this equipment has a long life span and therefore the time it takes people to respond to changes in prices and income may lag the actual price or income change. Further, this lag will vary over time and can also be dependent on energy prices or income (e.g., high energy prices encourage innovation of more energy efficient equipment). These factors make it difficult to estimate the energy demand response to price and income.

Elasticities are used to measure the responsiveness of energy demand to changes in economic variables, such as energy prices or income. Elasticities are calculated by estimating the corresponding percent change in energy demand to a per cent change in energy prices or income. Elasticities are examined in both the short-run and the long-run. The short-run refers to a period of time where some inputs are fixed and consumers can not as easily respond to changes. Long-run consumers have more choices and could, for example, buy more efficient energy-using equipment to respond to changes in energy prices.

Various economic models have been proposed to estimate the elasticity of energy demand. Dr. Bernard uses one of these methods to examine residential, commercial and industrial energy demand in Quebec between 1962 and 2002. He found that consumers are responsive to changes in fundamental economic variables, such as price and income.

Over time, energy demand in the residential sector in Quebec is moving upward, which is consistent with the movement toward larger house and apartment sizes and decreasing average number of household members. The commercial sector energy trend is decreasing, which is associated with increasing urbanization and larger buildings that provide office and trade space. It is less energy intensive to provide services in urban areas versus rural areas. Finally, there is no discernable pattern in industrial energy demand trends.

In addition to presenting his paper on energy demand models and elasticities, Dr. Bernard also provided insight on the energy pricing debate taking place in Quebec. The debate surrounds the appropriate pricing of electricity. Currently, the energy price is based on

the average historical cost of supplying electricity. As a result, Quebec enjoys relatively low electricity prices compared to other national and international jurisdictions. Some argue that Quebec's electricity rate should be set at the marginal cost of supply to account for required investments in more expensive generation, such as wind and new hydro projects. Increasing the price of electricity to match the marginal cost rather than the historical average cost could result in additional provincial revenues, which could be used to service Quebec's debt or fund healthcare initiatives. The higher marginal cost will also send a signal to the market regarding the scarcity of energy and could result in more efficient use of energy resources. On the other hand, it is argued that lower electricity prices help entice energy intensive industries to Quebec creating jobs and ensuring low electricity costs for residential consumers.

Daniel Violette: Demand Side Management (DSM): Future Role in Energy Markets

Summit Blue Consulting

Dr. Violette was invited to share his vast experience and knowledge on the development and implementation of demand-side management (DSM) programs.

Demand-side management in this context refers to changes in consumers' electricity use in response to market conditions. A number of different actions are included under DSM. Conservation is defined as using less energy over many hours. An example of conservation is seen in investments in energy efficiency improvements to reduce electricity demand and manage energy bills. Demand response (DR) uses less electricity when prices and/or production costs are high. DR can be event-based (tied to operator notification) or non-event-based. Operators notify customers to reduce electricity use or that energy prices will be high during a time period when reliability is a concern. In this way, event-based response can be tied to load or price signals. Non-event-based response occurs in the absence of operator notification and can include time- of-use pricing (e.g., day-ahead prices, hourly prices or real-time prices). Load management is defined as moving electricity demand from high price periods to low price periods.

Dr. Violette identifies two boom periods for DSM. The first boom occurred from the 1980s to the mid-1990s and was a reaction to the oil embargos. Governments and consumers became concerned with forecasted increases in oil and natural gas prices, which are inputs into electricity generation. Interest in energy efficiency improvements and the development of energy efficiency programs arose. In the end, energy prices declined in real terms as supply increased in response to the higher energy prices and consumers lost interest in DSM.

The second boom began in 2000 and continues today. The new interest in demand side management is again influenced by higher oil and gas prices. However, an important driver in this second boom is risk mitigation. There is a significant amount of uncertainty in energy markets today. Energy prices are higher, but there is also price volatility, the future of environmental regulations is unknown (e.g., carbon constraints, mercury, etc.) and there are transmission and pipeline infrastructure constraints. Demand-side management options are viewed as a low-cost energy "resource" that diversifies the supply portfolio and provides a physical hedge against these uncertainties. The focus of DSM in the second boom is energy efficiency improvements and DR.

A critical component of demand management is energy prices that send signals to the market regarding scarcity of energy resources, such as on-peak electricity. Suitable pricing of energy will achieve efficient resource allocation in markets, encourage innovation in energy management technologies and improve productivity in the electricity sector, which is a highly capital-intensive industry.

There is a misconception that energy efficiency programs are easy to implement. The process of getting energy customers to participate in energy conservation is very difficult. Dr. Violette attributes this challenge to a concept called “bounded rationality”, which says consumers do not examine every possible option open to them due to limited available information and their ability to handle its complexity. Rather, consumers only consider those options that occur to them. Therefore, you have to create energy conservation awareness which requires a significant amount of time and effort.

The successful development of DSM programs requires a number of factors, including setting the appropriate target, providing the right incentives and program monitoring and evaluation. Setting the appropriate target for DSM programs requires extensive analyses of DSM potential within each jurisdiction, including the evaluation of the existing infrastructure available to deliver the programs (e.g., the number of certified energy auditors). This analysis will result in different DSM targets for different jurisdictions. Texas anticipates that 10 percent of annual growth will be met by DSM, whereas Illinois has proposed sustainable energy plans which start at 10 per cent and then ramp up to 25 percent of growth.

Providing utilities with incentives to pursue DSM has been shown to impact delivery of DSM programs. In the absence of an incentive, the implementation of these programs could result in lower margins due to reduction in electricity and/or gas sales and this could act as a disincentive for utilities to actively pursue DSM. A modest incentive could make pursuing these programs more appealing.

Program monitoring and evaluation is critical to successful DSM programs. The key elements of evaluation include early identification of measurement criteria to be used, comprehensive data collection (e.g., track participant contact information, customer costs, equipment replacements, etc.) and an ex-post evaluation to confirm that the expected benefits are actually occurring. This is critical to the development of a baseline from which to evaluate the impacts of the program. Stand-alone evaluations conducted after several years have proven to be insufficient to measure benefits. For example, it is difficult to measure the actual energy savings if data was not collected on the equipment that was in place prior to the program.

Dr. Violette presented results from a study of DSM completed by Summit Blue Consulting. They found that DSM programs helped ensure energy needs are met at lower overall costs and with lower price volatility. A small demand response can have a large impact on overall prices because the supply curve is very steep on the margin.

The development of DSM programs is an important ingredient for market efficiency. It requires building demand-side management infrastructure (e.g., standards and codes of practices, available energy efficient equipment, qualified labour force, etc.), and setting appropriate price signals that enable customers to respond and to allocate scarce resources. Demand-side management programs pose challenges; however, they provide flexibility and balance out supply side risks.

Alison Bailie: Sustainability and Energy Efficiency in Canada

Pembina Institute

Ms. Bailie from the Pembina Institute was asked to speak about how sustainability ties into Canadian energy demand as well as consumers' response to higher energy prices.

The desire for sustainability is driven by heightened awareness of the environmental impacts of energy production and use, including climate change and local environmental impacts (e.g., urban smog, water consumption, water pollution and land-use). It is also driven by higher energy prices, which are contributing to energy poverty in Canada. The development of energy efficiency programs can help reduce energy demand resulting in decreased environmental impacts and lower energy bills.

Climate change is expected to have a significant impact on human health, economics, and ecosystems. Climate change has been linked to the mountain pine beetle infestation in British Columbia because the pine beetle thrives on warmer winters and drier summers. To avoid "dangerous" effects of climate change, it is estimated that the average increase in temperature should be limited to 2 C above the pre-industrial level. This implies a need to reduce global greenhouse gas emissions 30 to 50 per cent below 1990 levels by 2050. Part of the climate change solution is to reduce energy demand through improvements in energy efficiency, which will have the co-benefit of reducing local environmental impacts.

Energy poverty is an issue in Canada and has become more pressing as energy prices increase. Roughly 4.2 million low-income Canadians are at risk. In response to the higher energy prices experienced in recent years, some groups are calling for a national low-income energy efficiency policy.

Internationally, many jurisdictions have demonstrated innovative ways of dealing with these issues through comprehensive government policies, such as California's energy efficiency program. Some of the key components of the program are updating appliance standards and building codes every three years, establishing energy savings requirements for utilities and setting targets for improvements in existing state buildings. In addition, California is also regulating greenhouse gas emissions from vehicles, which will likely have the additional benefit of energy efficiency improvements in the transportation sector.

The United Kingdom has also adopted a number of policies to encourage energy efficiency improvements, including setting energy savings requirements for utilities and development of building codes and labelling for more efficient homes. These initiatives are supported by monitoring and verification programs to ensure promised savings are actually being realized.

Canada has some experience in the implementation of energy efficiency programs, such as building codes and appliance standards. The national experience in this area suggests

the need for long-term commitments and regular policy updates. Frequent and predictable revisions of these policies allow businesses to plan ahead and more easily respond to changes in regulations and ensure maximum energy efficiency improvements are realized.

In addition to building codes and appliance standards, a number of other innovative policy approaches have also been adopted in other jurisdictions, which could be explored in Canada. One option is to impose mandatory energy saving requirements on utilities. Another approach could be the adoption of Public Benefit Funds which are used in many U.S. states. The fund is collected either through a small charge on the bill of every electric customer or through specified contributions from utilities. This fund is used to support energy efficiency or renewable energy projects. Another option is financing energy efficiency using local improvement charges, which is already a policy tool used in many Canadian municipalities. In addition, many of the climate change policies implemented around the world, such as emission caps or changes, could be used to help meet Canada's commitment under the Kyoto Protocol and support energy efficiency improvements.

Over the next 10 years, the three aspects of sustainability that are going to become more important are climate change, local impacts of energy production and use and energy poverty. These three issues can be dealt with through energy efficiency improvements. Governments will be expected to play a strong role in facilitating these improvements by setting long-term goals, providing the necessary funding and ensuring commitments are met through the development of monitoring and verification programs.

Conclusion

The Consumer Response to High Energy Prices Panel Discussion was held to develop a better understanding of how consumers will respond to the higher energy prices they are experiencing. This information will be incorporated into the Board's analysis of energy markets for the 2007 Energy Futures report.

The presenters highlighted that energy demand is influenced by a number of factors, including:

- domestic and international economic growth;
- changes in the structural mix of economies;
- technological advancements;
- capital stock and capital stock turnover;
- energy efficiency improvements;
- energy prices; and
- government policies.

The current high energy price environment is expected to make energy use more "top of mind". Consumers might choose to reduce energy demand in the short run through conservation efforts (e.g., turning down the thermostat) or in the long run by investing in more energy efficient equipment. The implementation of government policies can help manage energy demand. Uncertainty surrounding how quickly consumers will respond to increased prices and how long their response might last remains. More light will be shed on this area as data becomes available.

Speaker Biographies

Ms. Alison Bailie – Senior Technical and Policy Advisor, Pembina Institute

Ms. Bailie is a part of the Sustainable Communities Group of the Pembina Institute, where she is engaged in community energy planning and energy policy analysis in Canada. Prior to joining the Pembina Institute, she worked for the past five years at the Tellus Institute (Boston). She has led numerous projects that have analyzed the effectiveness of energy policies for reducing greenhouse gas emissions in all sectors of the economy at the national and state level. Ms. Bailie's background is in quantitative analysis of energy policy, primarily using models to test environmental impacts and cost-effectiveness of a wide range of actions. She received her Master of Resource Management Degree from Simon Fraser University in 1994.

Dr. Jean-Thomas Bernard – Professor, Département d'économique Université Laval

Dr. Bernard earned his Honours in Economics from the University of Ottawa in 1968 and his PhD in Economics from the University of Pennsylvania in 1973. He was a Professor of Economics at Queen's University in Kingston, Ontario from 1973 to 1976 and at Université Laval in Quebec City from 1976 to the present.

Dr. Bernard has held a number of positions, including a visiting professor at the University of British Columbia (1980-1981); a Research Fellow at Harvard University (1987-1988); a Fullbright Foundation Fellow at Cornell University (1994-1995); the head of GREEN, which is a Natural Resources and Environment Research Center at Université Laval (1988-1994); the Head of the Economics Department at Université Laval (1996-1998); and Gilbert White Fellow at Resources for the Future (2001-2002). He is currently the Chair professor of electricity economics at Université Laval.

His fields of specialization include natural resources and energy economics. He has published more than 50 papers which have appeared in numerous refereed journals.

Dr. Judith Dwarkin – Chief Economist, Ross Smith Energy Group

Dr. Dwarkin's vast expertise includes energy market operations and regulation, transportation issues and energy policy. Before joining Ross Smith, she was Senior Vice-President, Global Energy with the Canadian Energy Research Institute (CERI), where she managed the domestic and international research program pertaining to crude oil markets and prices, as well as the Institute's Conference and Training divisions. Prior to joining CERI, Dr. Dwarkin was a Managing Director with the Alberta Petroleum Marketing Commission, where she was responsible for oil and gas market analysis and energy regulatory interventions on behalf of the Alberta Government. She holds a BA and MA in Economics from the University of Calgary and a PhD in Agricultural Economics from the University of New England, based in New South Wales, Australia.

Mr. Nick Fulford – Senior Vice President, Head of Upstream, Gas and LNG, Direct Energy

Prior to Mr. Fulford's position as the Senior Vice President (SVP) Head of Upstream, Gas and LNG, he was SVP Business Development, responsible for a wide range of development activities across North America.

In 1999, Mr. Fulford led the team investigating North American market entry opportunities, and was a key negotiating figure for the Direct Energy acquisition in August 2000.

With the British Gas Corporate Centre since 1993, Mr. Fulford also worked directly with the Board on restructuring issues arising from market reform, playing a significant part in the creation of Centrica plc and the demerger of British Gas in 1997. He has assumed various senior appointments within Centrica, focusing on take or pay contract renegotiation, risk management activities and various company acquisitions.

Mr. Fulford joined British Gas in 1983 following his tenure with the U.K. Ministry of Defense. At British Gas, he undertook various technical assessments of gas infrastructure projects. After moving to a more commercial role in gas purchasing, Mr. Fulford participated in various contractual arrangements arising from the deregulation of the industrial and commercial market in the early 1990s before moving to an international management assignment in the Far East and Trinidad.

Mr. Fulford graduated from Durham University with a Bachelor of Science in Engineering Science in 1979 and subsequently obtained his Master of Science from the Royal Military College of Science in 1981.

Dr. John Nyboer – Executive Director, Canadian Industrial Energy End-use Data and Analysis Centre (CIEEDAC)

Dr. Nyboer has more than 17 years of experience in energy modelling, policy and analysis and issues related to greenhouse gas emissions. He has played an integral role in the development of end-use models of energy demand in all sectors for all regions across Canada and is currently participating in the debate surrounding Canada's signing of the Kyoto Protocol for greenhouse gas reduction. To this end, Dr. Nyboer is co-author of a book entitled *The Cost of Climate Policy* and publishes work related to this area as the co-director of the Energy and Materials Research Group (EMRG) at the Simon Fraser University (SFU).

As Executive Director of CIEEDAC, Dr. Nyboer has also developed an international reputation on the development and use of energy data and the development of energy intensity and energy efficiency indicators for industry.

Dr. Nyboer is a University Research Associate and an adjunct professor in the Resource and Environmental Management program at Simon Fraser University (SFU) and acts as

advisor to many graduate students there. He has undergraduate degrees in biology (B.Sc., University of Alberta) and education (B.Ed., University of Toronto) and holds a Masters and Doctorate in Natural Resource Management from SFU.

Mr. Nicola Pochettino – Senior Energy Analysis, International Energy Agency (IEA)

Mr. Pochettino is a senior energy analyst in the Economic Analysis Division of the International Energy Agency (IEA). A permanent member of the World Energy Outlook team, he focuses on international oil and gas markets analysis and forecasting. In particular, he built a world oil-equilibrium model and conducted a field-by-field oil supply study for the Middle East and North Africa in the World Energy Outlook 2005. He has broad experience of both corporate and general securities work in the energy field, gained as a business analyst at the Italian oil major Eni and the Italian leading investment bank Unicredit Banca Mobiliare. He has published equity research on listed utilities and energy companies. In recent years, he has also lectured at the Scuola Mattei, Eni's post-graduate education centre for energy and environmental management. He is a graduate nuclear engineer of Turin Polytechnic and has a Masters in Energy Management.

Dr. Daniel M. Violette – Principal, Summit Blue Consulting

Dr. Violette is a principal in the strategy practice at Summit Blue Consulting with over 20 years of experience in the power and networked industries. Prior to joining Summit Blue Consulting, Dr. Violette spent 15 years at Hagler Bailly Consulting where he co-managed the firm's retail utility practice. He was one of the founders of the firm and led the firm's utility practice for over a decade. He also served in senior executive positions at EDS Management Consultants and at Xnergy Inc. Dr. Violette is recognized in the utility industry for his work on resource planning, innovative pricing and rates and DSM planning, implementation and evaluation for utilities across North America.

He has managed over a dozen evaluations of portfolios of electric resources (supply-side and demand-side), as well as serving on planning collaboratives and advisory panels. He has published compendiums and handbooks on DSM policy issues and evaluation methods and he has sponsored testimony in over 20 jurisdictions on behalf of commissions, utilities and regional organizations.

Dr. Violette is a past President of the Association of Energy Services Professionals International (AESP) and currently is the Vice-Chair of the Peak Load Alliance. Dr. Violette received his PhD in Economics from the University of Colorado specializing in industrial organization and quantitative methods.

Presentations