



Nuclear Power's Role in Enhancing Energy Security in a Dangerous World

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Introduction:

Should we be concerned about energy security? Several recent publications and organizations have identified concerns. For example, the International Energy Agency's World Energy Outlook for 2004 states that if governments stick with the policies in force as of mid-2004, the world's energy needs will be almost 60% higher than now and fossil fuels will continue to dominate the global energy mix. This reliance creates uncertainty about the cost to extract these resources and deliver them to consumers. It also increases the potential for supply disruptions as the industrialized world, including the United States (US), becomes ever more dependent on imports from distant, often politically-unstable parts of the world. It also means climate-destabilizing carbon-dioxide emissions will continue to rise, calling into question the sustainability of the current energy system.

Nuclear power, which is the fourth most important source of primary energy (after oil, coal and natural gas) and fourth most important source of electricity (after coal, hydro and natural gas) in the world, offers strong public policy and business cases for its expansion globally and in both the United States (US) and Canada:

- Nuclear power can readily displace coal as a source of base-load electricity generation and reduce the dominance of fossil fuels;
- Electricity supplied from nuclear power tends to come with stable prices as the cost of the uranium which fuels nuclear power plants is a small percentage of the overall cost of power;
- Canada is the largest supplier of uranium to world markets and has the third largest reserves;
- Nuclear power plants release no carbon-dioxide emissions and are the largest such source of GHG emissions-free electricity generation in Canada and the US; and •
- Nuclear power is the only proven option that can generate primary energy on the vastly increased scale required to provide the hydrogen "bridge" to a fully clean- energy economy.

Background:

Nuclear power plants in the US currently produce about 20% of that nation's electricity. This nuclear-generated electricity is safe, clean (nuclear energy accounts for nearly 70% of all US emission-free generation) and economical (less than 2 cents/kWh), and does not emit greenhouse gases. Continued and expanded reliance on nuclear energy is one key to meeting future demand for electricity in the US and is called for in the National Energy Policy. The Energy Information Administration (IEO2004) is forecasting nuclear generating capacity will increase by 2025 with power uprates and no plant closures.

Nuclear power plants in Canada currently produce about 14% of our nation's electricity. There are currently 17 nuclear power reactors operating in Canada. There are plans to bring three units at Ontario Power Generation's Pickering power plant back into operation over the next several years, and the Ontario government is negotiating with the Bruce Power Partnership to re-start two additional reactors at Bruce Power. Canada's nuclear capacity is therefore projected to increase from approximately 10,000 MW in 2001 to 15,000 MW in 2020 (IEO2004).

The return of the Bruce and Pickering nuclear units in Ontario should help the provincial government in its efforts to eliminate coal-fired generation in that province.

Key Facts:

- The United States was the largest electricity market in the world (3,993 TWh) and Canada the fifth largest (601 TWh) in 2002. The two markets are significantly integrated with respect to fuel supply for electricity generation (Canada imports coal from the US, the US imports natural gas and uranium from Canada) and electricity generation proper (numerous inter-ties allow electricity to flow both ways across the border).
- At the present time, Canadian exports of uranium to the US can account for upwards of 50% of annual consumption, meaning Canadian uranium may fuel 10% of all US electricity generation.
- Increased capacity factors at the 103 US nuclear power plants since 1990 have resulted in the equivalent of 25 new 1,000 MW power plants coming on line. Each 1% increase in capacity factors results in a 1% increase in demand for uranium.
- The United States Department of Energy has put in place a program to identify sites for new nuclear power plants, to develop advanced nuclear plant technologies, and to demonstrate new regulatory processes. The program is meant to lead private companies to decide to order new nuclear power plants by 2010. Two industry consortia have recently been awarded cost-shared funds to test out the new combined construction and operating licence. One

consortium is proposing to build one of Atomic Energy of Canada Ltd.'s new-design advanced CANDU reactors.

- The global impact of nuclear power will be determined in part by the continued strong safety record of existing plants, and by the record of new reactors in terms of timely construction, economic maintenance and safety. Canada will have a role in the global nuclear power industry as a supplier of uranium and new-generation nuclear reactors.

Key Issues:

Nuclear's acceptability as a source of energy is influenced by a number of issues:

- The rising cost of fossil fuels generally, and the price and availability of natural gas regionally;
- Improved safety and efficiency performance in existing reactors (as evidenced by life extensions, higher capacity factors and capacity uprates);
- The development of new reactor designs featuring simpler designs that enhance safety and economics (e.g. the ACR in Canada, the AP1000 in the US);
- World compliance with carbon emission reduction policies (such as the Kyoto Protocol);
- Nuclear waste disposal (though there is general consensus among scientific organizations worldwide that stable, deep, geological formations are the best locations for waste repositories);
- Public acceptance of nuclear energy; and
- Non-proliferation of nuclear material.

Choices for Canadians:

- Will Canada's climate change plan recognize the contribution nuclear power makes today to lowering Canada's greenhouse gas emissions (nuclear generation has likely avoided in excess of 200 million tonnes in CO₂ emissions from 1990 to 2001 and will likely avoid an additional 300 million tonnes from 2002 to 2017), and provide a policy incentive to further investments – be they refurbishments or new builds – in nuclear power?
- Canada's current climate change plan does not recognize the contribution from existing non-emitting sources of electricity – hydro and nuclear

- Both of these sources of electricity are capital intensive and require substantial financial investment and time before the investor (public or private) realizes any return
- Both also face the prospect of regulatory delays when compared to natural gas power plants
- Future environmental or health restrictions on carbon dioxide emissions and pollutants such as sulphur dioxide and nitrogen oxides could further increase the cost of fossil fuels and make non-emitting sources of electricity generation (nuclear, hydro and other renewables) more economically attractive
- Will Canada continue to contribute to the development of the advanced CANDU reactor and its deployment in the near term?
 - Investment in advanced nuclear technologies offer the potential to repeat the significant growth experienced by nuclear power from its widespread adoption in the early 1970s (nuclear energy had the largest demand growth from 1971 to 2002 in North America of the “top 5” energy sources – coal, oil, gas, nuclear and hydro)
 - Power generation is projected to remain the largest carbon dioxide emitting sector (approximately 40%), in North America, even with the increased use of natural gas and renewables in the generating fuel mix
 - Replacing Ontario’s coal-fired generation (7,500 MW) with nuclear energy would allow Ontario to meet UallU of its share of Canada’s Kyoto commitments – making a significant contribution to Canada’s efforts
- What energy path will Canada “choose” – the “Supply Push” or the “Techno-Vert” as identified by the National Energy Board (NEB 2003)?
 - The Supply Push scenario represents a world in which technology advances gradually and Canadians take limited action with respect to the environment
 - Characterized by continued reliance on “inexpensive” fossil fuels
 - The Techno-Vert scenario represents a world in which technology advances rapidly and Canadians take broad action with respect to the environment
 - Characterized by the increased use of nuclear and renewables

Key Developments to Watch:

- The first nuclear new build decision in North America is expected by 2010 (in the US).
- The report of the Nuclear Waste Management Organization in Canada (November 2005) recommending a waste management option for Canada's nuclear fuel waste, and the licensing of Yucca Mountain in the US (by 2007/2008) as that country's repository for geological disposal.
- Investments in new fuel cycle facilities to meet the needs of the North American industry.

Recommendations:

- Canada should recognize the sustainable features of nuclear power (technically sound, economically feasible and environmentally and socially acceptable) and not reduce its reliance on nuclear power.
- Canada should recognize the value of non-emitting sources of electricity generation in its climate change plan and provide appropriate incentives recognizing they (nuclear, hydro and wind) tend to have high capital costs.
- Canada should ensure that its environmental assessment and regulatory approval processes do not bias the choice of one electricity generating option over another.
- Canada should ensure it has a predictable licensing process for the consideration of new nuclear plants.
- Canada should consider nuclear power as an important component of its future energy mix – for both electricity and hydrogen generation – as the world's increasingly reliance on fossil fuels may increase uncertainty in the global energy market.