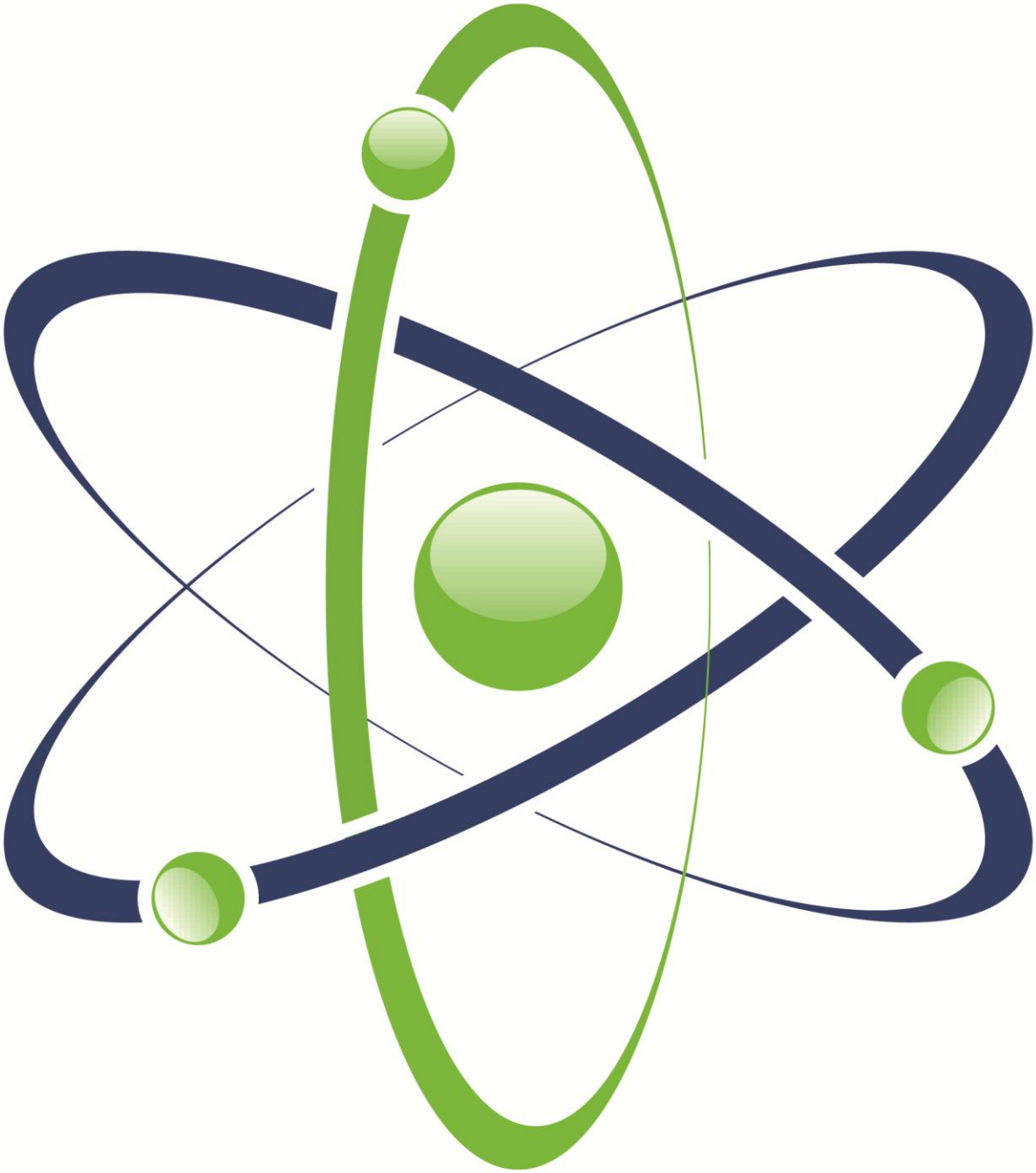
THE FUTURE OF CANADA'S NUCLEAR ENERGY SECTOR

Toronto workshop summary report
July 2013



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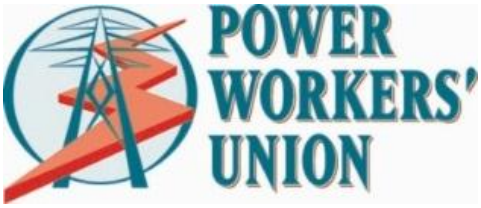

Project overview

On May 23, 2013, Canada's Public Policy Forum convened leaders from the private, public, academic and research sectors in Toronto to explore the future of the Canadian nuclear sector. The day focused on whether and how Canada's nuclear energy industry can take better advantage of domestic and international market opportunities in the medium term (the next 20 years). The purpose of the workshop was to engage subject experts from across the industry to identify the opportunities, challenges and potential long-term outlook for nuclear energy in our country. Workshop participants were asked to explore key policy questions, including: what is the potential for Canada to take advantage of opportunities? Where are the sector's strengths and vulnerabilities? What are the main challenges, and how can they be addressed? This report summarizes some of the key discussions at the workshop.

There is a great deal of overlap between the opportunities and challenges facing Canada's nuclear energy sector

Strengthening our country's nuclear energy sector will require a commitment to adopt Canadian products and services for domestic use.

Within the energy sector, there is a common perception that expanding exports will depend on whether Canada is able to demonstrate to the world that it champions its own technology and services at home. Our main international competitors – France, Russia, South Korea and the United States – all procure their domestic products and services. According to some workshop participants, a country's willingness to purchase from its own industries demonstrates confidence and is often a prerequisite for other nations that are looking to make purchases as well.

Over the next decade, there are a number of opportunities where Canada could bolster its industries by making greater investments in nuclear energy. Recent refurbishments at the Darlington and Bruce power plants have both been successful and relatively cost-effective, helping to show that our country's nuclear energy sector can manage complex projects. According to some participants, demonstrating confidence in our domestic nuclear industry might require the construction of large and small nuclear power plants. For example, refurbishments in Ontario, as well as building new plants in Ontario, Alberta, Saskatchewan and, potentially, New Brunswick would deliver significant benefits to Canada's trade opportunities and our economy:

- Constructing new nuclear power plants would create and reinvigorate nuclear supply chains in Canada;

- Refurbishments and new builds attract skilled workers, and provide demand for high-skilled university and college graduates;

- The manufacturing and deployment of small modular reactors (SMRs) would allow new companies to invest in Canada, create more jobs and expand Canada's expertise beyond CANDU and heavy water reactor (HWR) technologies, and;

- Increasing the share of nuclear energy in Canada would help diversify our country's energy mix, providing cost-effective, safe, low-carbon emitting, and sustainable source of energy.

The international market for nuclear energy reactors, materials and services continues to grow.

The speed with which Asian and Latin American economies are growing and consuming energy means that Canada's nuclear energy sector will be presented with numerous opportunities to construct and service reactors in key international markets. The United Kingdom, China, India and Argentina are all seeking to expand their nuclear energy capabilities with plans to build new power plants. With decades of experience in these growing markets, CANDU is well positioned to expand its presence and is currently seeking to be more competitive by looking at further using enhanced fuel and used uranium.

According to workshop participants, as demand for nuclear energy shifts east, it is unclear which country will be a leader in providing nuclear products, services and expertise. Canada's recently concluded Nuclear Co-operation Agreements with India and China represent a positive first step towards facilitating the flow of nuclear products and services to new markets. Additional nuclear cooperation agreements could produce new opportunities for Canadian firms to export reactors, uranium and technical and scientific services.

Introducing fuel recycling into India and China and marketing CANDU reactors for fuel efficiency to Russia and the UK could yield even greater benefits for Canadian industry leaders. Increased global demand for nuclear energy products and services will also help to improve and provide Canada's supply chain with new opportunities to expand.

Canada's ability to grow as a nuclear energy power will require greater innovation, partnerships and regulation.

As a Tier 1 country with almost 70 years of experience in nuclear energy, Canada already has a strong reputation for delivering quality products, services and expertise. However, years of cutbacks and the absence of a coherent long-term strategy mean that Canada risks falling behind international competitors who are well financed largely by governments, have up-to-date infrastructure and enjoy political support. In order to grow as an industry, workshop participants suggested that Canadian leaders need to create a national nuclear innovation lab to help facilitate R&D and provide training for nuclear experts. In terms of SMRs, many Canadian organizations lack the necessary facilities to understand and research new technologies, and need a national laboratory to help support these projects and fix issues over the reactors' life spans. This institution could act as an important "backbone" that supports Canada's industry in both national and international operations.

Further, building a new research reactor could provide greater capacity to understand and control a power plant's life-cycle management. With Canada's aging fleet of reactors, there is a need to create centres of excellence across the country in order to develop expertise and innovative approaches, as well as to find ways to extend the life of Canada's older reactors. This knowledge could then be exported to other jurisdictions.

Canada also has an opportunity to leverage public-private partnerships to help drive an accelerated nuclear innovation agenda in Canada. Through innovative partnerships that facilitate risk-sharing and funding arrangements, public and private leaders would be better positioned to develop new technologies, products and services. For example, loan guarantees, subsidies and other funding arrangements will be vital for supporting Canada's nuclear industry as it constructs power plants within and outside of Canada. However, it is important to note that these projects cannot be financed by government alone. Ensuring private sector "buy-in" will require that industry leaders contribute capital and resources towards nuclear energy projects, research and development. According to workshop participants, creating an environment where public-private partnerships flourish will lead to big returns for the country.

Participants also noted that if the Darlington refurbishment does not successfullyconvince decision-makers that power plants can be built in a timely and affordable manner, "it will not bode well for future builds". The experiences in the United Kingdom and New Brunswick can help provide guidance. Should government support dwindle on nuclear energy and without a decision to keep funding it, there will be significant implications for the nuclear value chain, and it is unclear how long it would take to rebuild the sector. According to participants, leaders need to ensure that the sector is not tied to any one project that could affect future government decisions on the sector as a whole.

Continuing to update Canada's regulatory framework so that it incorporates SMRs and new technologies will be important for licensing, commercialization and deploying reactors in a timely manner. A transparent regulatory system is also helpful for attracting foreign investment and ensuring potential customers that Canada is able to effectively understand and safely manage innovation and new technologies in the sector.

There is also a need for greater alignment around liability. Canada's $75M cap is relatively low by international standards. According to some participants, it should rise to $650M so that it is more helpful to plant operators.[1] Internationally, Canada has an interest in increasing liability regulations in developing countries such as India and China, since existing levels there are so low that it makes it difficult for Canadian companies to export to these countries.

The nuclear energy sector requires not only scientists and engineers, but businessmen and marketing experts to tell "Canada's nuclear story"

A key challenge and potential opportunity is the need to attract professionals outside of the traditional nuclear energy industry to help build a business and communications case for the country's nuclear energy sector. Public perception of nuclear energy is a key obstacle for creating the political will that is necessary to generate the level of support that could make Canada's industries more globally competitive. According to participants, most engineers and specialists do not feel that it is their responsibility to advocate on behalf of the industry. Therefore, the industry requires a greater communication capacity and enhanced ability to sell products and services to new markets.

Developing Canada's nuclear energy industry could allow our country to use more renewable energy sources.

If electric vehicles become more popular, they could create a greater demand for electricity. The University of Waterloo is currently looking at the pressures that these vehicles could place on Canadian electricity grids and how policymakers might respond. According to participants, nuclear energy could be a cheap and viable option for meeting this potential increase in electricity demand.

Using nuclear power in the oil sands could also be helpful to reduce GHG emissions, increase yields and reduce the cost of production.

[1] On June 10, 2013 the Government of Canada announced plans to increase the liability ceiling to $1 billion, under proposed new federal legislation.

Conceptualizing a positive scenario of the nuclear energy sector 20 to 25 years into the future

During the afternoon session of the workshop, participants were asked to identify what a "successful" Canadian nuclear energy industry would look like 20 to 25 years into the future. At a relatively high-level, a vision for Canada was outlined and a number of factors were identified as being necessary to realize it.

A vision for Canada's nuclear energy sector

For Canada's nuclear energy sector to be thriving two decades into the future, a greater use of nuclear power facilities, products and services will be required to meet domestic energy needs. More specifically, participants suggested that more nuclear power plants would need to be in operation in large markets, such as Ontario and Quebec; SMRs and vSMRs will have need to have been adopted to provide energy to remote and northern communities, potentially including the Alberta oil sands, and; provinces such as Alberta, New Brunswick and Nova Scotia have will need to put plans in place to build their own reactors.

This scenario also envisions that steps will have already been taken to ensure that the entire nuclear energy value chain is strengthened and made more competitive. For example, a more concerted attempt would have been made towards public-private partnerships to build a nuclear research reactor to support researchers, businesses and governments. The industry would have successfully communicated its message, resulting in greater political will and social license to build and expand facilities. Universities and colleges would produce greater numbers of technical experts and business professionals to help drive the industry forward. And Canada's uranium industry, currently the second largest in the world after Kazakhstan, would be more developed, would have generated greater foreign investment and, potentially, moved towards providing uranium enrichment services.

With a stronger domestic presence, this vision suggests that Canada's nuclear energy sector would also be far more competitive internationally. Participants suggested that a positive scenario for Canada would see our country exporting more CANDU mixed oxide fuel (MOX) reactors to the United Kingdom; establishing a presence within the US market; dramatically increasing the number of reactors sold to China and other emerging economies, and; fostering CANDU as a global leader.

With a greater share of the global nuclear energy market, Canada's services and expert communities will also be stronger and better positioned to provide products, expertise, training and services to international customers.

In order to achieve this positive domestic-international vision for the future, participants suggested that a number of key milestones would need to have been realized, including: support from the financial, social and environmental communities to expand the industry; developing an ability to provide global customers with more fuel options, and; building greater R&D capability, supported by a strong, specialized and well-educated workforce.

Strong support for the industry from government as well as from the financial community and environmental non-government organizations (ENGOs)

- Canada's nuclear energy sector enjoys strong federal support and there is political will to expand operations at home and push for greater exports abroad.
- ENGOs both recognize and promote nuclear energy as a safe, sustainable energy supply.
- Nuclear energy is viewed in Canada and internationally as a vital component of a country's energy mix, and an important factor in reducing carbon emissions.
- Private sector leaders feel a more confident about investing in the sector, and are supported through power purchase agreements (PPAs), loan guarantees and risk sharing arrangements.
- A memorandum of understanding is signed between federal and provincial governments to ensure that expectations, regulations and resources are better aligned.

Greater reactor sales in Canadian and global markets

- The private, public and academic sectors collaborate to help spur innovation in Canada's nuclear reactor technology.
- There is greater federal and provincial cooperation around the regulation of SMRs, and a national strategy that guides their use and deployment.
- Leaders in the reactor industry have been aggressive in marketing their products in new markets, using a multi-stakeholder, collaborative "Team Canada" approach.

- CANDU technology is established as an effective fuel cycle reactor.
- Canada adopts and designs its own SMR technology, allowing Canadian firms to export products, services and expertise.
- The refurbishments at Bruce and Darlington have been completed on time and on budget, demonstrating to world customers that Canada can manage large power plant projects efficiently.
- Canada has a coherent strategy for commercializing different technologies, products and services offered throughout the supply chain.

An ability to provide global customers with greater fuel options

- Canada provides products and services across all fuel options, including natural and enriched uranium, MOX and thorium.
- The Cigar Lake uranium mine project in Saskatchewan has come into service and is supplying the world with uranium.
- Additional Nuclear Co-operation Agreements have been signed, allowing Canada to export into new markets.
- Canada has a greater capacity throughout the entire uranium process (e.g. enrichment, reprocessing and conversion processing).
- Canada becomes the world leader in the sustainable development of uranium mining, production, fuel conversion and export.

A greater R&D capacity and more advanced human capital pool

- Canada creates additional research networks and builds on existing centres, such as the University Network of Excellence in Nuclear Engineering (UNENE), and in doing so becomes a global leader in providing students with nuclear energy education.
- The Chalk River Laboratory has been successfully refurbished and now flourishes as a global

R&D institution.

- The federal government has a coherent and long-term vision for how it will support and fund nuclear R&D; the provincial governments play a key role in supporting R&D through funding, education and other policy initiatives.

- Canada has a new research reactor that provides greater research capacity.

- Canada enjoys a vibrant, sustainable and growing nuclear energy sector that attracts high-skilled labour from across the world.

The steps stakeholders could take in the short-term to realize the positive vision for the future

Participants offered some insight into the steps that might need to be taken in the short-term to help make the positive vision possible. Two specific scenarios were identified as possible over the next five years:

Scenario 1: Over the next five years, there is no political decision to build new nuclear plants in Canada.

In the absence of a decision to move ahead with new builds in Canada, participants were concerned that the capacity of our country's nuclear supply chain and expertise would be significantly reduced. In order to mitigate the effects of this potential scenario, stakeholders could take a number of steps to sustain the industry, including:

- Ensuring that Canada has an innovative R&D environment that can provide new products, services and expertise to domestic and international customers.

- Building federal and provincial support for all aspects of the industry (e.g. reactor design, uranium mining, worker training, etc.). Even if there has not been a decision to construct new power plants, F-P/T governments could still provide loan guarantees for a new research reactor.

- Finally, participants suggested that if demand for nuclear products does not increase in Canada's domestic market, the industry would need to focus on making inroads into global markets. In order to do this effectively, the industry should consider using many of the strategies outlined above (e.g. private-public partnerships, pursuing nuclear co-operation agreements with other countries, re-establishing "Team Canada" missions, etc.)

Scenario 2: Over the next five years, Canadian governments have decided to build new nuclear power plants.

Although the construction of new power plants in Canada would no doubt be a positive step for the industry, there are steps that would first need to be taken to help ensure that these projects enjoy public support and meet budget and time expectations. Some of these steps include:

- Creating a coherent communications and government relations strategy (federal and provincial)
- Forming advocacy groups beyond the nuclear sector
- Engaging with the public through consultations, public engagement seminars and the use social media
- Using political leaders and a Team Canada approach to sell abroad
- Exploring all options for generating financial support for new builds

The Future of Canada's Nuclear Energy Sector

Toronto workshop

May 23, 2013 9:00 a.m. – 4:00 p.m.

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