Ontario’s Nuclear Industry - the way forward

Ron Oberth
President
Organization of Canadian Nuclear Industries

Mayors’ Nuclear Technology Caucus Meeting
April 5, 2013
Canadian Nuclear Industry

- **Canada was a successful nuclear pioneer**
  - 60 years of nuclear technology development
  - Developer of CANDU nuclear technology

- **Nuclear energy is a $7 B/year industry**
  - 30,000 jobs (plant operations, services, equipment supply, uranium mining, regulation and R&D)
  - More than $1 B/year in exports
  - World’s second largest exporter of uranium
Key organizations and facilities in Ontario’s nuclear industry

Network Organizations
OCI Overview

- OCI is an industry association of 175 private sector suppliers of products and services to Canadian and offshore nuclear plants.

- OCI Mandate:
  - *advocate for continued reliance on nuclear power in Ontario as part of a reliable, low carbon and cost effective supply portfolio*
Nuclear Power Plants - worldwide

- Traditional concentrations of NPP’s have been focused in N.America and Europe with new growth centres focused in Asia
- China and India could build more NPP’s than the rest of the world combined

North America: 124 in operation, 10 planned or under construction
Western Europe: 130 in operation, 3 planned or under construction
Eastern Europe & Russia: 67 in operation, 41 planned or under construction
Africa & Middle East: 3 in operation, 8 planned or under construction
Southern & Eastern Asia: 109 in operation, 133 planned or under construction

In operation
Planned or under construction, Source: World Nuclear Association
There are 48 CANDU and CANDU-type reactors in the world representing approximately 10% of the global fleet of 442 reactors.
Nuclear Power In Ontario

Bruce Nuclear Power Site
Nuclear Power In Ontario

Darlington Nuclear Power Station
The CANDU plant in New Brunswick supplies 40% of the provinces electrical energy.

The CANDU plant in Quebec is scheduled for decommissioning.
Managing Used Nuclear Fuel

- One 20 Kg CANDU fuel bundle produces the same amount of electricity as 400 Tonnes (4 rail cars) of coal

- All used nuclear fuel is now stored at reactor sites in pools or concrete containers

- Canada’s total inventory of used nuclear fuel could be stored in a facility equivalent to a football field to a height of two meters
Canada’s Plan for the Long-Term Management of Used Nuclear Fuel

- The Government of Canada has approved a plan for the long-term management of used nuclear fuel.
- The “Adaptive Phased Management Program” involves interim storage at reactor sites followed by above ground centralized storage and finally deep geologic disposal in a stable and tested rock formation.
- 15 communities in two provinces have expressed interest in hosting the facility.
Electricity Sources in Ontario (2012)

Energy Output by Fuel Type (2012)

- Nuclear: 56.4%
- Gas: 14.6%
- Hydro: 22.3%
- Coal: 2.8%
- Wind: 3.0%
- Other: 0.8%

Source: Independent Electricity System Operator (IESO), 2012
HERO'S WHY ONTARIO, CANADA IS YOUR NEXT BIG IDEA

In Ontario, Canada clean energy powers growth. Recent investments totaling more than $10 billion make it a leader in renewable energy development. Home to the largest wind and solar farms in Canada, we are serious about building our renewable energy capacity. Our generous R&D tax credits combined with our highly skilled workforce is fueling innovation, and our central location provides access to a market of more than 420 million potential customers. As more clean energy projects come online—wind, solar and bioenergy—Ontario is on-track to phasing out coal-fired electricity entirely. A clean future starts here. Make Ontario your next big idea.

YourNextBigIdea.ca/Renewables
Nuclear Up / Coal Down
*(Bruce Power website)*

WITH THE RETURN TO SERVICE of Units 1 and 2, combined with the Restart of Units 3 and 4 in 2004, and strong operational performance from Bruce B, Bruce Power’s output will increase by 25 terrawatt hours (TWh) of energy annually by 2013. Coal output during the same period has dropped by 32 TWh.
Ontario’s Long Term Energy Plan

• Ontario’s Long Term Energy Plan calls for the refurbishment of existing CANDU units at Darlington and Bruce as well as the construction of new nuclear units at the Darlington Site to maintain a balanced and reliable electricity supply portfolio.

• Final decisions to proceed on these large projects are pending
Ontario needs robust and diversified power system to sustain and attract industry

- OPA Supply-Demand Forecast shows surplus supply in near term, adequate supply mid term and need for new supply in 2022 (March/12)
OCI Advocacy Campaign

• Strapolec is preparing an “Ontario Electricity Supply Option White Paper” that analyzes three supply option scenarios (with varying amounts of nuclear, renewables and gas-fired generation) and contrasts the impacts (10 to 20 years) on:
  – total electricity system costs (residential and industrial rates)
  – total greenhouse gas emissions from power generation
  – energy industry jobs created for each MWh of electricity

• White Paper results (May 2013) will underpin the OCI Advocacy Campaign including meetings with Ontario Govt., opposition party leaders and stakeholder groups such as the Mayors Council.

• OCI is also planning a more aggressive media campaign including earned media, radio ads and increased use of social media such as Facebook, Twitter and YouTube
Strapolec Phase 1 Study Results (Feb 2013)

Total Energy Costs by Supply Type ($B)

- 2011
- 2012 (est)
- 2013
- 2014
- 2015 (OPA)
- 2016
- 2017

- Nuclear
- Gas + Coal
- Hydro
- Non Hydro Renewables
- NUGs
- Conservation

54% Increase
Forecast ->
Strapolec Phase 1 Study Results (Feb 2013)

Strapolec Monthly Residential Rate Forecast
Typical 800 kWh consumption using LTEP 2011 starting point

52% Growth
Forecast -->

$ / 800kWh

2011 (est) 2012 2013 2014 2015 2016 2017

HST Debt Reduction Regulatory Delivery Electricity After OCEB
Strapolec Phase 1 Study Results (Feb 2013)

Tx-Connected Industrial Electricity Cost Forecast

($/MWh)

$100

$80

$60

$40

$20

$0


Gap Triples 34% Increase

Historical

Forecast

Strapolec Forecast

US Average
## Public Support for Nuclear – Ontario

### 2012 Public Opinion Research
National Nuclear Attitude Survey

#### Ontario Results

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In favor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refurbishment</td>
<td>68%</td>
<td>63%</td>
</tr>
<tr>
<td>New Build</td>
<td>50%</td>
<td>48%</td>
</tr>
</tbody>
</table>

*(CNA 2012)*
Public Support for Nuclear – UK

Support for replacement new build reaches a new high point of 50%

Base: Ipsos MORI poll. Base: All adults aged 16+ (1,000 – 2,000). Fieldwork December 2011
Public Support for Nuclear – UK

Thinking about providing for Britain's future energy generation needs, which of the following do you support the MOST?

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Support (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
<td>26%</td>
</tr>
<tr>
<td>Wind</td>
<td>18%</td>
</tr>
<tr>
<td>Tidal/Wave</td>
<td>18%</td>
</tr>
<tr>
<td>Solar</td>
<td>16%</td>
</tr>
<tr>
<td>Gas</td>
<td>5%</td>
</tr>
<tr>
<td>Coal</td>
<td>2%</td>
</tr>
<tr>
<td>None</td>
<td>1%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>14%</td>
</tr>
</tbody>
</table>


www.niauk.org
Refurbishment and Construction of New Nuclear Units has strong community support

- “Overall, a new nuclear plant at Darlington will have significant positive socio-economic impacts for the Municipality of Clarington, including, among other things:
  - *Increase in employment*
  - *Increase in business activity*”

(Presentation by Clarington Board of Trade to New Nuclear at Darlington Joint Review Panel, March 21, 2011)

- “Clarington and Durham are preparing infrastructure to receive construction forces, related consultants, office development. Clarington is proud to be host to New Build”

(Presentation by Municipality of Clarington Mayor Adrian Foster to New Nuclear at Darlington Joint Review Panel, March 24, 2011)
Wind often divides communities

- "The FIT program is affecting everyone in Ontario through higher electricity rates," said Wind Concerns Ontario president Jane Wilson. "And it's not necessary. Coal is virtually gone as a power source. We don't need more expensive unreliable wind power, and Ontario electricity customers don't need to be subsidizing huge power corporations. End the FIT, now."

- Citizen groups plan demonstrations this week to tell the Premier their communities are "not willing hosts" to wind power projects. Events are scheduled in Belleville, Toronto, Seaforth, Listowel and Ottawa.

SOURCE: Wind Concerns Ontario (April 1, 2013)
Nuclear Electricity is Affordable

- The average cost of electricity from nuclear units (high capital cost and low fueling cost):
  - *Darlington & Bruce B units* ~ 5.2-5.5 cents/kWh
  - *Refurbished Bruce units* ~ 6.8 cents/kWh
  - *New Units* ~ 8 - 10 cents/kWh

- Ontario’s revised Feed In Tariffs (*not including back-up gas*):
  - *Wind* - $11.5 cents/kWh and up
  - *Solar* - 35 cents/kWh and up

- Combined cycle gas plants (with gas at $4/MMBTU) are currently the low cost option (without a carbon tax)
  - *Long term price risks if price of gas in NA moves to world levels or production curtailed due to environmental concerns over “fracking”*
Economic (Jobs) Impact of Refurbishments

- Annual Economic Benefit of Refurbishment and Operations (10 Refurbishments plus Operations during the Refurbishment Program Period (2016 - 2024))

<table>
<thead>
<tr>
<th></th>
<th>Refurbishment</th>
<th>Operations</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>10,600</td>
<td>16,600</td>
<td>27,200</td>
</tr>
<tr>
<td>Labour Income</td>
<td>$1.2 B</td>
<td>$2.1 B</td>
<td>$3.3 B</td>
</tr>
<tr>
<td>Fuel Cost</td>
<td>-</td>
<td>$0.5 B</td>
<td>$0.5 B</td>
</tr>
<tr>
<td>Equipment</td>
<td>$1.9 B</td>
<td>$1.2 B</td>
<td>$3.1 B</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$3.1 B</td>
<td>$3.8 B</td>
<td>$6.9 B</td>
</tr>
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Canadian Manufacturers and Exporters (Sept. 2012)
**Economic (Jobs) Impact of New Build**

- Annual Economic Impact of Building a New Two-Unit Nuclear Power Plant at Darlington (over five years)

<table>
<thead>
<tr>
<th></th>
<th>Direct</th>
<th>Secondary</th>
<th>Total Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>10,800</td>
<td>10,800</td>
<td>21,600</td>
</tr>
<tr>
<td>Labour Income</td>
<td>$0.8 B</td>
<td>$1.12 B</td>
<td>$1.92 B</td>
</tr>
<tr>
<td>Equipment</td>
<td>$1.38 B</td>
<td>$1.52 B</td>
<td>$2.90 B</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$2.18 B</td>
<td>$2.64 B</td>
<td>$4.82 B</td>
</tr>
</tbody>
</table>

**Canadian Manufacturers and Exporters (Sept. 2012)**
A Tale of Two States
“The wind and solar mandate means future power shortages.”

“The state's renewable energy standard will soon cause a surge in electricity prices and could even lead to rolling blackouts when the weather heats up.”

“In 2006, the state passed a law requiring utilities to derive 20% of their power from renewables by 2010. The mandate has since been increased to 33% by 2020.”

“Utilities have been in such a rush to bring new wind and solar projects online that they've been locking in long-term rates with developers that are often two to four times higher than what they pay for non-renewables”

“California residents and businesses already pay rates that are 25% to 60% higher than the national average. Excessive energy costs have helped to obliterate the state's manufacturing base”
“Congratulations are due for SCANA Corp. and all of us in the Carolinas. The Nuclear Regulatory Commission recently approved the operating license for two new advanced-design Westinghouse AP1000 nuclear plants at the V.C. Summer Plant in Jenkinsville, S.C., about an hour south of the Charlotte region.”

“The facility bolsters economic-development prospects for us all in the region. Industry moves to locations with stable, ample and affordable electricity. Companies including Google and Facebook recently chose the Carolinas for facilities, in part, for the ample and carbonless power that’s available with nuclear energy. These are terrific New Economy companies building for the first time in our region.”
• OPG awards $600 M Darlington Retube and Feeder Replacement Definition Phase Contract to SNC-Lavalin Nuclear / Aecon Nuclear Consortium (March, 1, 2012)

• CNSC Announces Environmental Assessment Decision on Darlington Refurbishment and Continued Operation (March 14, 2013)
  – “the proposed project is not likely to cause significant adverse environmental effects, taking into account mitigation measures identified in the EA Screening Report.”
Ontario Update - Refurbishments

- Duncan Hawthorne, Bruce Power President and CEO (Nov 2, 2012)

  “This week, Bruce Power was pleased to announce the completion of our investment program that returned Units 1 and 2 to operation, after they had been out of service since the mid-1990s.

- Bruce Power releases 2012 Annual Review titled ‘Revitalization’ (March 7, 2013)
  - Bruce Power has invested $7 billion to revitalize four dormant Bruce A units, returning 3,000 megawatts of reliable electricity to the grid, and securing and enhancing Bruce B.
  - This investment has assisted the Province of Ontario in achieving its goal of shutting down all coal-fired generation facilities. (Duncan Hawthorne, President and CEO)
CNSC Issues a Site Preparation Licence for OPG Darlington Nuclear Power Plant Project (August 17, 2012)

“The Joint Review Panel (JRP) of the Canadian Nuclear Safety Commission (CNSC) announced today its decision to issue a Nuclear Power Reactor Site Preparation Licence to Ontario Power Generation Inc. (OPG) for its new nuclear power plant project at the Darlington nuclear site for a period of 10 years.”
Ontario Update – New Build

• OPG Signs Services Agreements for New Nuclear - Services Agreements will help inform government decision on new nuclear (June 22, 2012)

  - **Ontario Power Generation Inc. (OPG) has signed agreements with Westinghouse and SNC-Lavalin/Candu Energy Inc. to prepare detailed construction plans, schedules and cost estimates for two potential nuclear reactors at Darlington.**

  - **Under the terms of the agreements, each company will be given 12 months to develop its report. The completed reports will be analyzed and forwarded to the Province for its consideration.**
• Electricity Supply Outlook (Rick Jennings, Ministry of Energy, CME Energy Roundtable, March 27, 2013):

  – **Ontario will continue to transition to a cleaner electricity supply mix**

  – **Coal will be phased-out by the end of 2014**

  – **Eight nuclear units at two plants (Darlington and Bruce) will be refurbished later this decade to provide continued reliable low-carbon generation**
Next Steps

• Nuclear will continue to be the main base-load supplier of low cost and low carbon electricity in Ontario

• But the timing of decisions to refurbish Darlington and Bruce Units and to construct new units at Darlington could have a profound impact on viability of Ontario’s nuclear supply industry

• A fact-based and consistent education and outreach program is critical to maintaining public support (and political support) for nuclear power - “social license to operate”

• The nuclear industry welcomes the support of local communities across Ontario that host our nuclear plants as well as the companies that supply them with fuel, equipment and services
PROMOTING A HEALTHY NUCLEAR SUPPLY CHAIN