OPG’s Nuclear Operations, Refurbishments and New Build Projects

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    • Scope of the Project
    • Environmental Studies
  - Public Consultation
  - Next Steps
Ontario’s Electricity Framework

Shareholder – Policy/Strategic Direction

Ontario

Ministry of Energy

Regulators, Supply Management & Planning

Ontario Energy Board

Ontario Power Authority

ieso

Power to Ontario. On Demand.

Generators/Bulk Transmission/Distributors

(Other generators)

Local Utilities and Distribution Companies

Consumers

(Other generators)
Ontario Power Generation

- Owned by Province of Ontario
- Supplies 70% of Ontario’s electricity
- Approx. 11,500 employees
- Over 22,000 MW of in-service capacity
  - 64 hydroelectric stations: 6,982 MW
  - 10 nuclear units: 6,606 MW (29% of Ontario’s electricity)
  - 5 fossil stations: 8,578 MW
OPG’s Nuclear Production: 2003-2007

*percentage of Ontario electricity demand
Nuclear Performance: Darlington

Performance recognized worldwide

Most improved performance -- INPO

Darlington units in top quartile among CANDU units

89.5% unit capability in 2007

Major planned outages completed on, or ahead of, schedule

Over 5 million hours worked without a lost time injury as of April 2008
Operational Performance: Pickering

**Pickering A**
- 2 million hours without lost time injury in 2007
- Decision to shut down Units 1 & 4 (June 2007) to modify backup electrical system negatively affected production

**Pickering B:**
- Inspection completed in 2006 on 1,554 fuel channels
- 4 million hours without lost time injury
- Production down slightly during 2007

**Pickering A & B site**
- 2007: Corporate Habitat of the year
- 5,000 trees planted over past four years
IPSP - 10,000 MW of Nuclear Power through Replacement and/or Refurbishment

Add over 6000 MW of fossil generation to be removed in 2014
Pickering B Refurbishment and Continued Operations EA Status & Typical Next Steps

- Ontario Power Generation (OPG):
  - Submitted Environmental Assessment Study Report (EASR) – December 17, 2007
  - Responds to any requests for clarification from CNSC/Federal authorities

- Canadian Nuclear Safety Commission (CNSC):
  - Accepts EASR
  - Issues Draft Screening Report for public comment (typically 4 – 6 weeks)
  - May hold public information sessions
  - Closes Public Review Period
  - Staff prepare Commission Member Document, submit to Secretariat
  - Issues notice of public hearing on Pickering B Screening Report
    - Public notifies CNSC of intent to participate 30 days before hearing
  - Holds public hearing (probably in Durham Region) on Screening Report
  - Issues Announcement re: Pickering B EA decision
<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2006</td>
<td>OPG submits Letter of Intent and Project Description to CNSC</td>
<td>✓</td>
</tr>
<tr>
<td>September 2006</td>
<td>CNSC releases Draft EA Guidelines for Public Review</td>
<td>✓</td>
</tr>
<tr>
<td>January ~ June 2007</td>
<td>CNSC Public Hearing on Guidelines</td>
<td>✓</td>
</tr>
<tr>
<td>July - June 2007</td>
<td>CNSC approves EA Guidelines</td>
<td>✓</td>
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<tr>
<td>December 17 2007</td>
<td>OPG submits Draft EA Study Report to CNSC</td>
<td>✓</td>
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<tr>
<td>2008</td>
<td>CNSC releases Draft Screening Report for Public Review (May hold public consultation sessions)</td>
<td>✓</td>
</tr>
<tr>
<td>2008</td>
<td>CNSC holds Public Hearing on Screening Report</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>CNSC releases Commission Decision on EA</td>
<td></td>
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Nuclear Refurbishment: Darlington

- Work on the refurbishment business case will start in 2008.
- EA to be submitted in 2010
Darlington New Build Project

- June 2006 OPG directed to begin the federal approvals process for new nuclear generation
- Requires completion of a federal Environmental Assessment prior to any licensing actions
- OPG submitted application to the Canadian Nuclear Safety Commission for a Project
  - to construct and operate a nuclear power plant with up to four nuclear units and up to 4,800 MW of electrical capacity (approximately 3.8 million homes)
  - to meet the base-load electricity requirements of Ontario
Federal Approvals

- June 2006 Provincial Ministry of Energy directed OPG to begin the federal approvals process for new nuclear generation
- Federal approvals involve two main federal agencies:
  - Canadian Nuclear Safety Commission (CNSC)
  - Canadian Environmental Assessment Agency
- The CNSC regulates nuclear power generation to prevent risk to the environment, health, safety and security
- The CNSC requires a separate licence for each of the 5 phases in the life cycle of a nuclear power plant:
  - Site Preparation
  - Construction
  - Operations
  - Decommissioning
  - Abandonment
- A federal Environmental Assessment (EA) must be carried out before a federal licence can be issued
Federal Approvals - Status

- OPG to submit additional Site Preparation Licence application information in 2009 (along with EIS):
  - Site program with a detailed scope of activities and activities schedule
  - Description of the organization
  - Proposed worker health and safety policies and procedures
  - A Nuclear Security Implementation Plan
  - Demonstration that any service providers and vendors have acceptable quality assurance programs, etc.


- Canadian Environmental Assessment Agency – announcement of Participant Funding – April 2008

- Next - Draft Panel Terms of Reference & Environmental Impact Statement Guidelines to be released for public review
Elements in an Environmental Assessment

2007 – Spring 2008

2007 – Spring 2008

2008

2008

2009

DESCRIPT THE PROJECT

DESCRIPT THE ENVIRONMENT

Determine how the project interacts with the environment

Malfunctions and accidents

Effects of environment on project

Environmental impact statement
Project Description
Site Preparation & Construction Phases

- Site Preparation Phase:
  - Activities to prepare the site for construction of the nuclear reactors and associated buildings
  - Approximately 2 years

- Construction Phase:
  - Activities to construct the nuclear reactors & associated buildings
  - Approximately 6 years (for first set of reactors)

Darlington Nuclear Generating Station site during Site Preparation (1980)
Project Description
Operations & Decommissioning Phases

- **Operations Phase:**
  - Work & activities that would occur on site during routine operation and maintenance of the plant
  - Assumes 60 years of full power operation per reactor
  - Mid-life refurbishment, if required

- **Decommissioning Phase:**
  - Major activities associated with decommissioning the reactors
  - Typically occurs about 30 years after the end of operation.
  - Dismantling may take an additional 5 to 10 years.
The dates shown are for EA study purposes. Actual start and in service dates have yet to be determined.
We are considering two classes of reactor technologies:

- **Pressurized Water Reactors (PWR)**
  - Low enriched uranium fuel, 4 – 5% U-235
  - Refuelling during major outages

- **Pressurized Light & Heavy Water Hybrid Reactors (PHR)**
  - Slightly enriched uranium fuel, up to 2.5% U-235
  - Online refuelling

Plant parameter envelopes:

- Need to consider the potential environmental effects of different reactors
- PPE approach based on U.S. practice for new nuclear plants
- Allows assessment of the potential safety and environmental effects
- Plant design ultimately chosen must fit within the PPE envelope
Project Description
Condenser Cooling - Alternatives

- Condenser Cooling - Alternatives
  - Once through lake water
  - Natural Draft Atmospheric
  - Mechanical Draft Atmospheric
  - May also consider - Fan Assisted Natural Draft

- Key Distinguishing Feature
  - Lake Water Cooling – heat transfer to lake
  - Atmospheric Cooling - airborne emissions – steam & chemicals
The EA will consider two on-site, safe, licensed used fuel storage options

- Expansion of the existing Darlington Waste Management storage structure to accommodate PHR (Candu-type) used fuel, or

- Building an additional used fuel dry storage and processing facility for PWR used fuel

The EA will consider two options for low and intermediate level waste management

- Manage the waste on the Darlington B site in an above ground storage warehouse, or

- Transport waste in licensed transport containers to an appropriately licensed facility
OPG has undertaken studies on site layout options

- Reactor Layout
- Road infrastructure
- Utilities
- Soil Removal and Excavation
- Site Access, etc.

At this stage we are beginning to develop various site layout configurations

Aerial of existing Darlington site with site layout options
Elements in an Environmental Assessment

- Describe the project
- Describe the environment
- Determine how the project interacts with the environment
- Malfunctions and accidents
- Effects of environment on project
- Environmental impact statement
Environment Description
EA Study Areas/Spatial Boundaries

Site Study Area

Regional Study Area →

Local Study Area
OPG has initiated baseline data collection for these Environmental Components:

- Atmospheric Environment
- Geology, Hydrogeology, Seismicity
- Land Use
- Physical and Cultural heritage resources
- Radiation & Radioactivity
- Surface Water, Aquatic
- Socio-economic conditions
- Terrestrial Environment
- Transportation

Other studies underway include

- Human Health
- Aboriginal Interests
- Sustainable Development
- Ecological Risk Assessment
- Malfunctions & Accidents (Safety & Security)

Additional studies or enhancements to these may be required
Environment Description
Environmental Baseline Studies - Findings

- Terrestrial Environment includes:
  - Vegetative communities, individual species
  - Wildlife communities, species
    - Birds, Mammals, Amphibians, Reptiles, Insects

- Baseline Studies
  - Extensive field surveys underway
  - Vegetation communities reflect extensive land use change over time
  - Shore bluff community contains a number of regionally rare plants
  - A few small woodlots remain
  - Mammals representative of common local species
  - More than 70 species of nesting birds on site
  - Dynamic butterfly, moths and dragonfly species on site
  - Bank swallow colonies found along shoreline bluffs
Environment Description

Environmental Baseline Studies - Findings

- **Land Use and Transportation** includes
  - Land Uses, zoning and permitting
  - Traffic
    - On site and off site
    - Road, Rail, Marine

- **Baseline Studies**
  - Up to date traffic studies are ongoing
  - Traffic counts around local study area
  - Road safety audits and study of collision history
  - School bus routing and schedule study
  - Employee survey, over 700 drivers
  - Railway and marine traffic data collection
Next Steps – Summer/Fall 2008

- Project – Environment Interactions Matrix
  - Identify Environmental Effects
  - Possible Mitigations
  - Determine Residual Effects

- Effects of the Environment on the Project
  - Climate change effects
  - Tornados, severe storms and flooding
  - Earthquakes

- Malfunctions and Accidents
  - Conventional malfunctions and accidents
  - Radiological malfunctions accidents
  - Nuclear accidents
  - Malevolent acts

- Cumulative effects of the project with other planned projects in the study area

- Mitigation and impact management measures

- The significance of any remaining (residual) effects
Get Involved!

There are many ways to get involved:

- Community Information Sessions
  - April 22 - May 9
  - Fall 2008 – Round 4
- Workshops & roundtable discussions
- Newsletters
- Briefing sessions
- Information booths at community events
- Information line/toll free #
- Website
- Brochures, information & fact sheets
- Visit our Information Centre
- Visit us at Bowmanville Mall

Community Information Session in Orono (November 2007)

Community Information Session in Oshawa November 2007 (UOIT)

Visitor filling out a comment form
Contact Us

www.opg.com/newbuild

1-866-487-6006
## Reactor Technologies Under Consideration

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Vendor</th>
<th>Single Unit</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 6 (Enhanced Candu)</td>
<td>AECL</td>
<td>700 MW</td>
<td>Evolution of Operating Plants - Quinshan</td>
</tr>
<tr>
<td>ACR-1000 (Advanced Candu Reactor)</td>
<td>AECL</td>
<td>1200 MW</td>
<td>Design underway Announced for Alberta</td>
</tr>
<tr>
<td>ABWR (Advanced boiling water reactor)</td>
<td>GE</td>
<td>600/900/1350 MW</td>
<td>Four Operating in Japan, 2 ordered for Taiwan</td>
</tr>
<tr>
<td>ESBWR (Economic simplified boiling water reactor)</td>
<td>GE</td>
<td>1500 MW</td>
<td>Evolution of ABWR</td>
</tr>
<tr>
<td>AP-1000 (PWR)</td>
<td>Westinghouse</td>
<td>1100 MW</td>
<td>New</td>
</tr>
<tr>
<td>EPR (European Pressurized Reactor)</td>
<td>AREVA</td>
<td>1600 MW</td>
<td>Under Construction – Finland, 1 planned for France</td>
</tr>
<tr>
<td>APR 1400 (PWR)</td>
<td>KHNP</td>
<td>1400 MW</td>
<td>New</td>
</tr>
<tr>
<td>OPR 1000 (Optimized Power Reactor)</td>
<td>KHNP</td>
<td>1000 MW</td>
<td>Eight Operating in Korea</td>
</tr>
<tr>
<td>US –APWR (Advance PWR)</td>
<td>Mitsubishi</td>
<td>1700 MW</td>
<td>Evolutionary</td>
</tr>
</tbody>
</table>
March 7 2008 Ontario Minister of Energy outlined a two-phase competitive Request For Proposal (RFP) process to select a nuclear reactor vendor.

Phase 1 - Proposals, submitted in May, will be evaluated for the following:
- Preliminary demonstration of capability to execute a plan to provide the support necessary for a successful construction licence review
- Demonstration of a plan to deliver a construction licence application on schedule and in compliance with Canadian regulatory requirements
- Respondent’s willingness and capacity to deliver the project
- Financial strength of the respondent
- Legal position of the respondent

Phase 2 - Commences end of June, submission content may include the following:
- Financial and commercial terms
- Respondent team members
- Schedule commitments
- Estimated operating and decommissioning costs
- Level of domestic economic value add
Vendor Selection Process

- A commercial team directed by Infrastructure Ontario and including OPG, Bruce Power and Ontario Ministries of Energy and Finance will manage the procurement process.

- Three internationally recognized vendors are participating in the first phase of the proposal process:
  - AREVA NP – US Evolutionary Pressurized Reactor
  - Atomic Energy of Canada Limited – ACR 1000 Advanced CANDU Reactor
  - Westinghouse Electric Company – AP 1000™ nuclear power plant

- Information is available on the Infrastructure Ontario web-site www.infrastructureontario.ca