



Nuclear Energy & Radioactive Waste Management in Canada

Policy, Plans and Priorities

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Outline

- Importance of Nuclear Energy in Canada
- Nuclear Players and their Role
- Legislative Framework for Nuclear Energy
- Legislative and Policy Framework for Radioactive Waste
- Long-Term Plans for Radioactive Wastes
- Canada's Evolving Landscape
- Closing Remarks

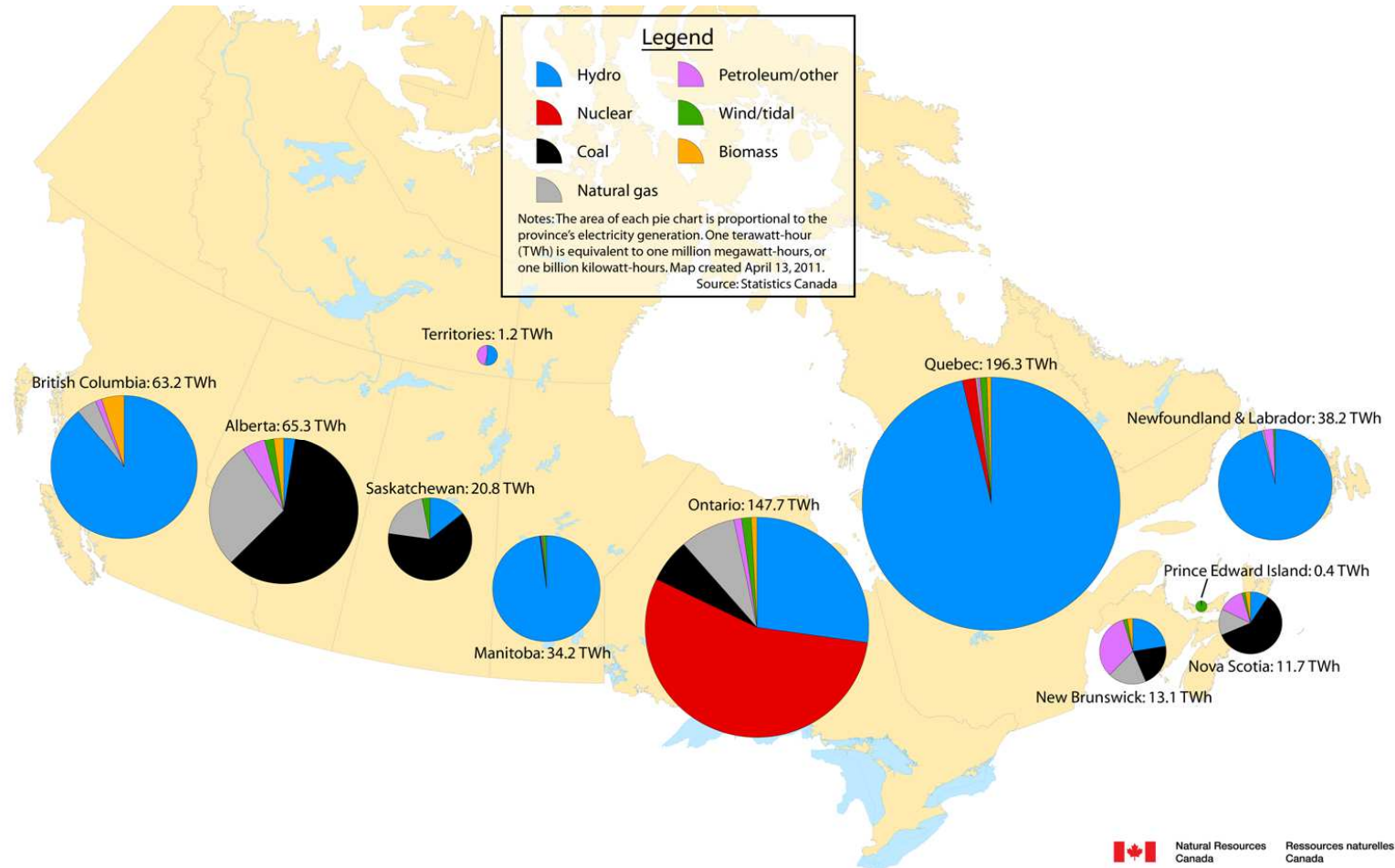


Canada's Place in the World

- Sixth largest oil producer (~3 MM BPD)
- Biggest exporter of oil to U.S. ahead of Saudi Arabia
- Third largest natural gas producer; fourth largest exporter
- Second largest uranium producer and exporter
- Fourth largest producer of hydroelectricity generation
 - 78% of power production is non-emitting
 - 15% of Canada's electricity generation is nuclear



Canada Has a Diverse Electricity Supply Mix



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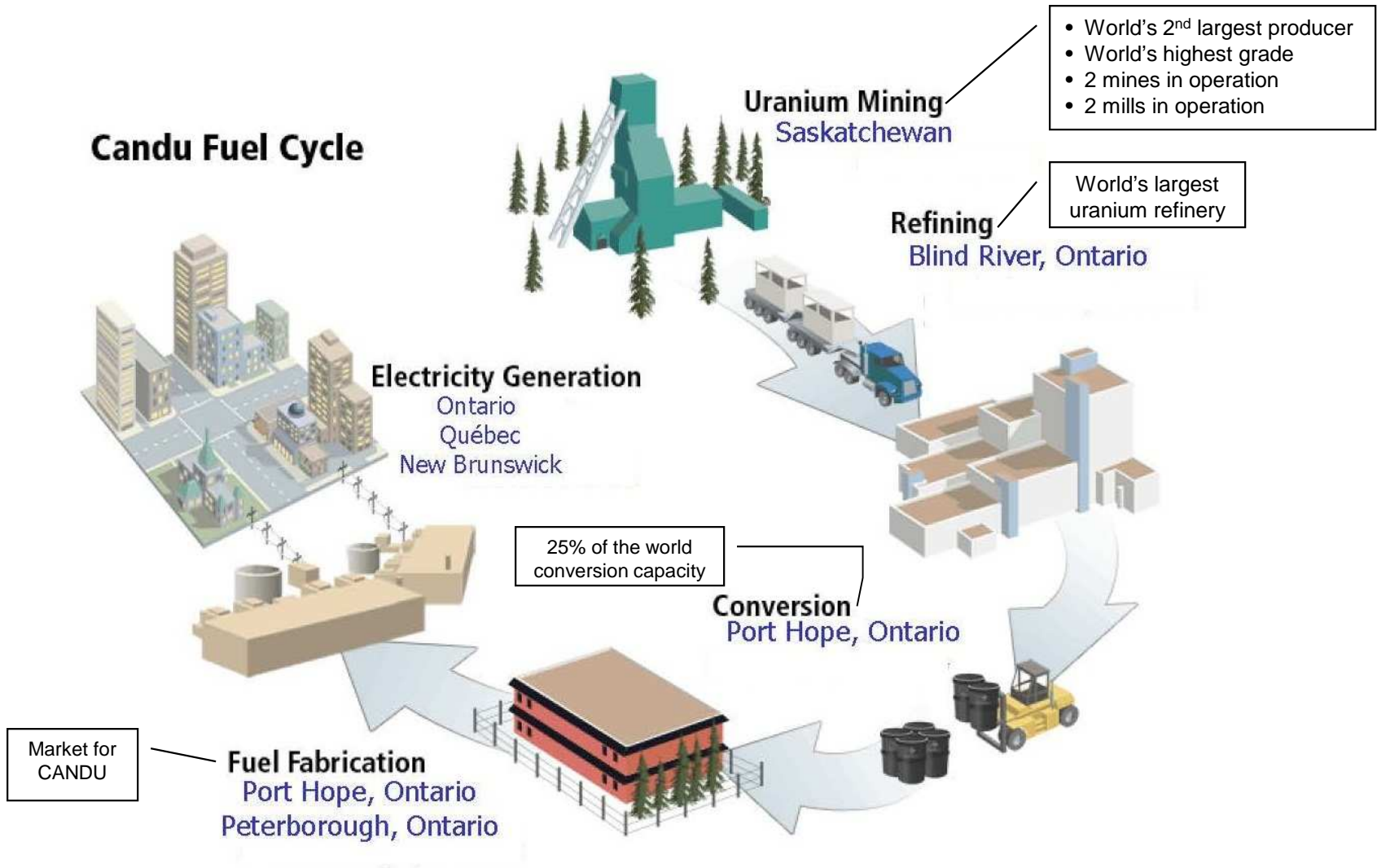
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Nuclear Energy

- Canada has over 60 years of experience in nuclear power
- Canada's self-sustaining nuclear industry
 - Integral to Canada's energy sector
 - Involved in all aspects for peaceful purposes
 - 21,000 direct jobs (source: Canadian Energy Research Institute (CERI) 2008)
 - Safe, efficient nuclear power technology CANDU with refurbishments extending reactor life by 30 years
 - 5000 direct jobs in uranium mining, milling, & fabrication
- Nuclear energy plays an important role in Canada
 - Four power plants – 19 reactors are currently operating
 - Six research reactors



Nuclear Fuel Cycle in Canada



Role of Nuclear Players

- **Federal Government**
 - Establish comprehensive framework for safe, secure and environmentally responsible application of nuclear fuel cycle, and uranium mines and mills
 - Encompasses nuclear R&D
 - **Natural Resources Canada** - responsible for Canadian nuclear policy - also works with Department of International Affairs on international nuclear policy
- **Provincial Government**
 - Own and manage resources
 - Uranium exploration
 - Decide on providers and mix of energy power supply
- **Government Agencies**
 - Canadian Nuclear Safety Commission (CNSC)
 - Canada's Independent Regulator
 - Atomic Energy of Canada Limited (AECL)
 - Crown corporation
- **Nuclear Industries**
 - Includes full spectrum of supply chain – mining to reactor vendor/operator
- **Nuclear Waste Management Organization (NWMO)**
 - Implementing agency for Canada's nuclear fuel waste plan



Canada's Legislative Framework for Nuclear Energy

- Nuclear falls within federal jurisdiction
 - General advantage of Canada
- Four key elements of legislative framework:
 - *Nuclear Safety and Control Act*
 - *Nuclear Energy Act*
 - *Nuclear Fuel Waste Act*
 - *Nuclear Liability Act*
- Other elements: Acts regarding environmental assessment, transport of dangerous goods, etc.



Radioactive Waste Policy

- Federal Role
 - ensure long-term waste management is carried out in a safe, environmentally-sound, comprehensive, cost-effective manner
 - develop policy, regulate, and oversee waste owners' compliance with legal, financial, and operational requirements
- Waste owners Role (e.g., utilities, AECL)
 - fund and manage their waste
 - develop and implement long-term solutions
- Federal Government is also a waste owner
 - responsible for historic and legacy waste management



Radioactive Waste Classification

- High-level radioactive waste (HLW)
- Intermediate-level radioactive waste (ILW)
- Low-level radioactive waste (LLW)
 - very-low-level short-lived radioactive waste (VSLLW)
 - very-low-level radioactive waste (VLLW)
- Uranium mine and mill tailings



HLW



ILW



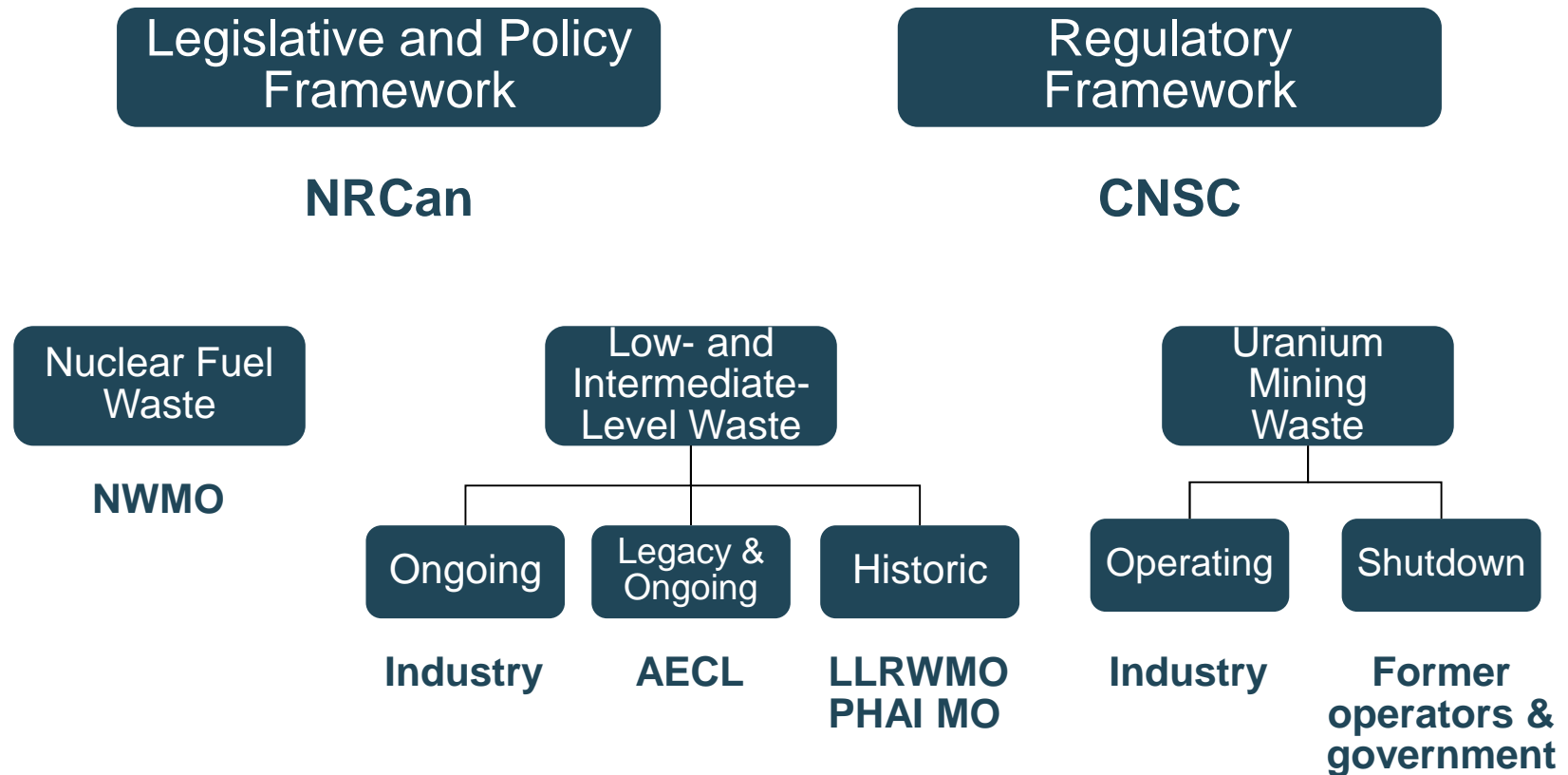
LLW



Uranium mine and mill tailings



Responsible Agencies for Radioactive Waste Management in Canada



Nuclear Fuel Waste Policy

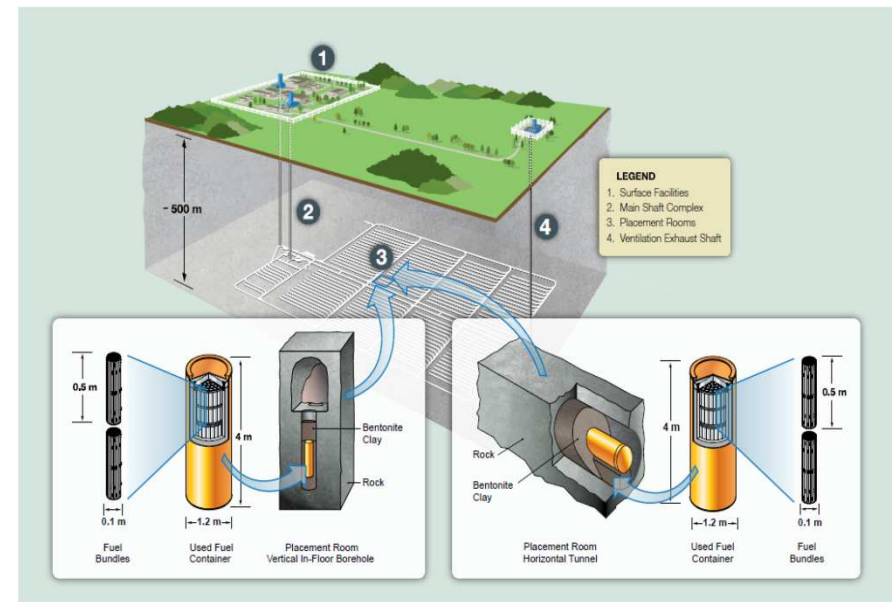
2002 Nuclear Fuel Waste Act

- Roles and Responsibilities
 - Federal Government
 - Develop policy, regulate activities
 - Provide oversight of waste owners and the NWMO activities for radioactive waste
 - Nuclear utilities
 - Establish Nuclear Waste Management Organization (NWMO) to develop and implement a long-term solution for nuclear fuel waste
 - Waste owners
 - Manage, fully fund, and implement solutions for radioactive waste



Canada's Plan for Nuclear Fuel Waste

- In 2007, the Government selected the Adaptive Phased Management approach
- NWMO responsible for its implementation
- Government oversight of implementation



Source: Safe and Secure Transportation of Canada's Used Nuclear Fuel, Fall 2012 – NWMO



Canada's Plan for Nuclear Fuel Waste (cont.)

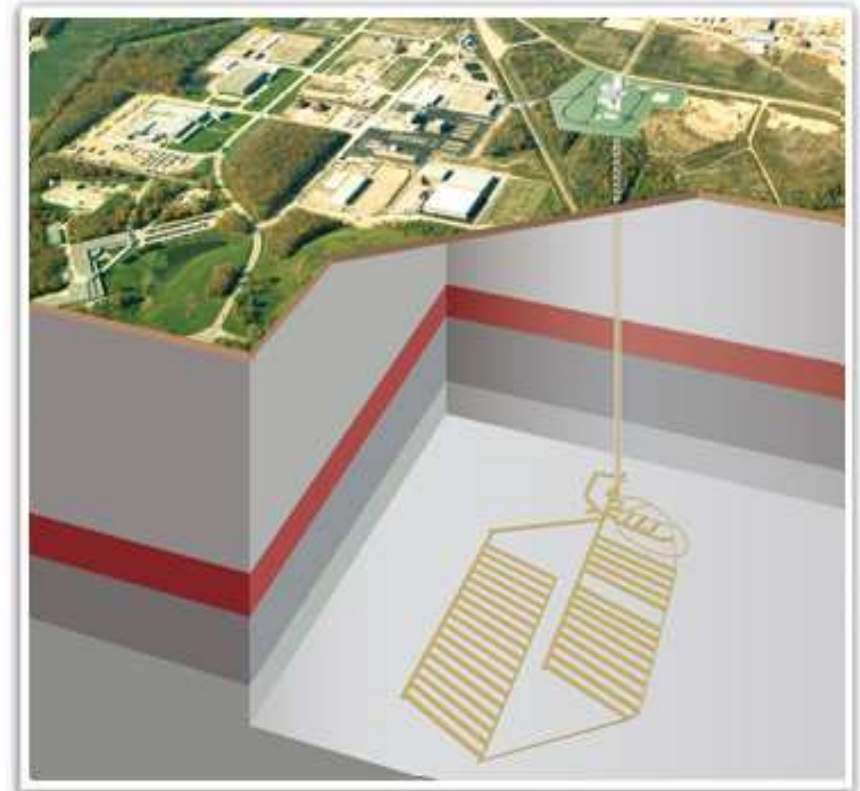
- Phased, adaptive, and community consent-based
 - NWMO Siting Process in Progress since May 2010
 - Seeking a voluntary community with a suitable site willing to host a deep underground facility (21 communities engaged in process)
 - Ongoing consultations with Canadians and Aboriginal Peoples
 - Special relationship within Canada

- National Infrastructure Project
 - \$16 to \$24 Billion investment in waste management facility
 - Significant socio-economic impact for host community and broader region
 - Hundreds of permanent jobs



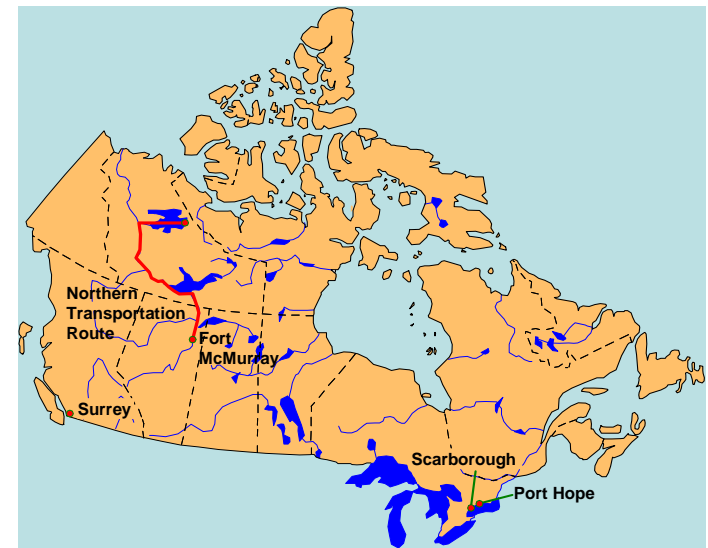
Plan for Low- and Intermediate Level Radioactive Waste

- Ontario Power Generation
 - Proposal to operate a DGR at nuclear site in Kincardine, Ontario
 - Regulatory review process underway
 - January 2012 Joint Review Panel appointed
 - Public hearing in 2013



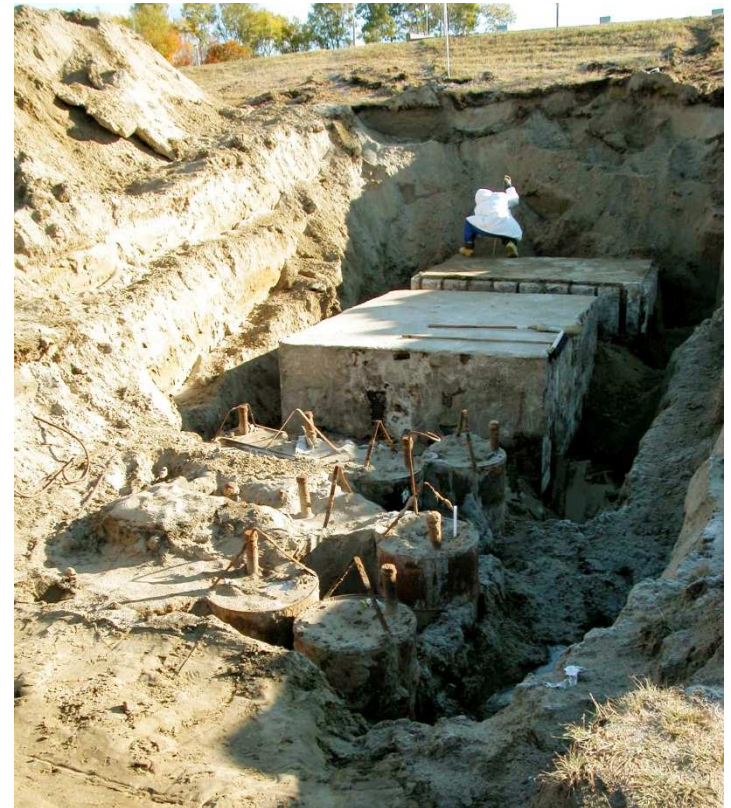
Plans for Historic Waste

- A federal responsibility
 - Managed by LLRWMO and PHAI MO
 - Over 90% located in Port Hope area
 - Known wastes under institutional control
- Port Hope Area Initiative
 - Waste and contaminated soils the result of uranium ore processing from 1930s
 - Way forward established between Canada and local Municipalities in 2001
 - Canada to fund cleanup initiative and Municipalities to host planned facilities
 - Planning phase completed in 2011
 - Government launched Implementation Phase in January 2012 (\$1.3 B over 11 years)



Program for Nuclear Legacy Liabilities

- Addressing decommissioning, site restoration and legacy waste liabilities at Atomic Energy of Canada Limited sites
- Government adopted long-term strategy, launched NLLP in 2006, renewed it in 2011
 - Total funding of \$959 M over 8 years
 - Current phase ends March 31, 2014
- Good progress to date
 - Waste clearance, processing and storage facilities constructed
 - Disused facilities, infrastructure (21,000 m³ total footprint) removed
 - High-hazard buried waste recovered, selected contaminated areas restored



Canada's Evolving Nuclear Landscape

- Provincial Interest in Nuclear
 - Quebec – Hydro-Québec (shutdown of G2)
 - New Brunswick – (Point Lepreau on line)
 - Ontario – new build and refurbishments
 - Saskatchewan – Canadian Centre for Nuclear Innovation

- AECL Restructuring
 - Sale of CANDU reactor division to Candu Energy Inc. (October 2011)
 - Phase 2 launched in February 2012 - focused on AECL's Nuclear Laboratories
 - Examining the long-term mandate and management model of the Nuclear Laboratories



Closing Remarks

- Nuclear is crucial part of Canada's clean energy mix
- Waste management is vital to continued success of nuclear and to addressing public perceptions
- Government of Canada remains committed to providing the policy, program support and oversight necessary to demonstrate that it takes radioactive waste management seriously
- Continued international dialogue and collaboration is essential, sharing best practices, and lesson learnt in radioactive waste management are key to building and sustaining public confidence and acceptance



Annexes

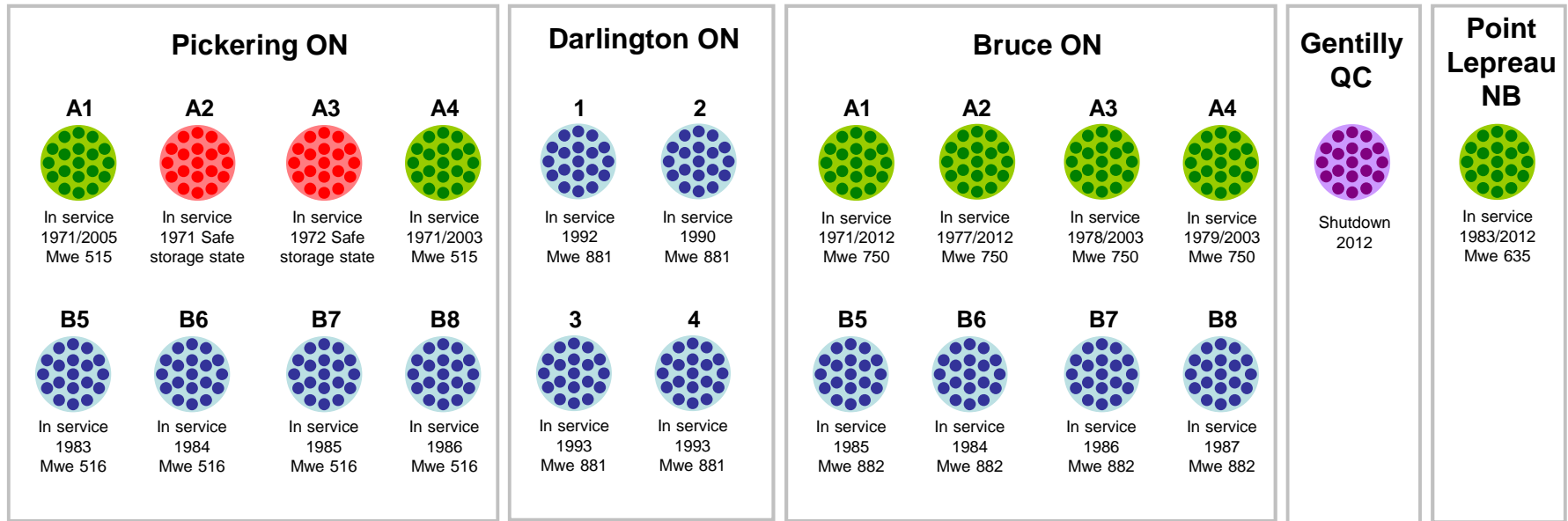


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Canada's Current Nuclear Energy Profile

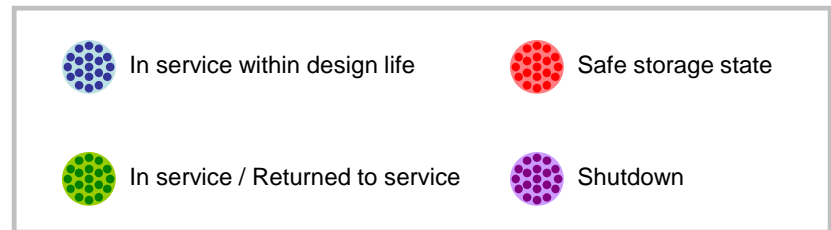


Total electricity generation

Canada – 14% Quebec – 0%
 Ontario – 57.6% New Brunswick – 30%

22 CANDU reactors

- 19 operating in Ontario – accounts for ~58%
- One recently shutdown in Quebec
- One operating in New Brunswick – accounts for ~30%



Potential New Builds in Canada

Darlington New Reactor Project

- Licence to Prepare Site issued by Canada's regulator (CNSC) in August 2012
- OPG request for cost, technical information for AP1000 (Westinghouse) and EC-6 (Candu Energy)
 - Anticipated summer 2013
 - Application for Licence to Construct will follow decision on technology



AP1000



EC-6



International Involvement in Nuclear

- Multilateral
 - International Atomic Energy Agency (IAEA)
 - OECD Nuclear Energy Agency (NEA)
 - G-8/G-20
 - International Framework for Nuclear Energy Cooperation (IFNEC)
 - Generation IV International Forum (GIF)

- Bilateral
 - A New Nuclear Cooperation Agreement (NCA) with India
 - 27 Existing NCAs (Argentina, Romania, China, Korea, U.S., etc.)

- Support for Prime Ministerial, Ministerial, and senior management negotiations/visits abroad



Radioactive Waste Management Sites in Canada



Opportunities & Challenges

- **Build and Sustain Public Confidence and Acceptance**
 - Maintain an open, fair and inclusive process that encourages citizen involvement
 - Provide ongoing information and education to the public
- **Consultations with Aboriginal Peoples**
 - Special relationship within Canada
 - Duty to Consult
- **Governance**
 - Ensure responsible organizations and management structures
 - Appropriate and balanced level of Government oversight
- **Safe Transportation of Nuclear Waste**
 - Greater public awareness and education
 - Early involvement of transportation agencies
 - Manage and address cross boundary issue (provincial, federal, and municipal)
- **Successful in finding a willing community to host a DGR**
 - Maintaining momentum with changes in leadership at various levels of government
 - Willingness of communities, including surrounding communities to host
- **International dialogue and collaboration is essential**
 - Adopting lesson learnt and best practices
 - Sharing and exchanging information
 - Working together through research and development activities

