Canada’s Tier 1 Nuclear Industry

**FLEET:** 19 operating CANDU Reactors in Canada at the Bruce Power, Darlington, Pickering, New Brunswick stations

**CANDU Technology:** SNC-Lavalin has exclusive rights to CANDU technology IP

**SUPPLY CHAIN:** 200+ companies providing products and services

**UTILITIES:** 3 nuclear reactor utilities safely operating the Fleet — Ontario Power Generation, Bruce Power, New Power

**R&D:** several internationally recognized facilities furthering nuclear innovation: Canadian Nuclear Labs (CNL) & universities

**EDUCATION:** institutions training high-skilled professionals for next generations: McMaster, U of T, U of W, Durham College, etc.

**MINING:** 2nd largest exporter of Uranium led by Cameco; Saskatchewan has highest-grade Uranium in the world

**WASTE MANAGEMENT:** global leader in permanent spent fuel disposal led by NWMO: Deep Geological Repository solution

**ASSOCIATIONS:** representing the industry and educating the general public: OCNI, CNA, CNS, NAYGN, WiN-Canada, UNENE

$68/year Industry 60,000 direct & indirect jobs 40,000 spin-off jobs $1.2B in exports

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**Policy Objectives**

**Recognize Nuclear as Clean Energy providing base load electricity**
- Nuclear electricity produces carbon emissions comparable to renewables
- Widely recognized as a key technology to combat climate change
- Nuclear is a key part of a low carbon electricity portfolio (e.g., 60% of Ontario’s electricity comes from nuclear)
- Provides reliable electricity: highest capacity factors

**Foster Socio-Economic benefits of the Nuclear Industry**
- Significant economic impact of major projects:
  - Life extension of Ontario fleet
  - New build in Canada and internationally
- Low cost electricity from nuclear fosters a competitive economy
- Creates long-term high-skilled jobs in science, technology and engineering
- Education programs maintain specialized skillset
- Non-power applications:
  - Medical imaging, diagnosis and cancer treatment
  - SMRs for desalination, mining, Oil & Gas
  - Develop aboriginal communities through delivery of electricity to remote locations

**Maintain Canada’s Nuclear Tier 1 status through investment in R&D / Innovation**
- Next Generation CANDU & advanced fuels
- Life Extension tooling and robotics
- Development of Small Modular Reactors (SMR) & Very Small Modular Reactors (VSMR)
- Development of Gen IV reactors
- Decommissioning and waste management (D&W) technology
- Maintain leadership in nuclear medicine applications
- Health imaging, diagnosis, cancer treatment

**Strengthen Canada’s International Nuclear Leadership and Engagement**
- Export Canadian-developed CANDU Technology to international markets such as China, Argentina, the UK and Romania
- Nuclear governance mentor: Internationally recognized nuclear regulator
- Diplomatic leader in:
  - Nuclear Trade
  - Nuclear disarmament
  - Nuclear at part of the climate change solution

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**Trends and Pressures**

**Government & Regulatory:**
- Importance of government support in export markets
- Complexity of nuclear export control regime impacts already long sales cycle
- Lack of global consensus on nuclear being “clean”

**Energy Market:**
- Federal and provincial pressure on carbon reductions
- Competition with heavily subsidized electricity generation sources (wind/solar)
- Low natural gas prices

**Social License:**
- Increased importance of social license: public acceptance & increased use of social media
- Misunderstanding of nuclear: peaceful vs. weapons
- Concerns regarding management of spent fuel and radioactive waste
- Increased engagement of aboriginal communities

**Industry Dynamics:**
- Industry shift & consolidation: major players merging, restructuring & exiting
- Workforce Generation Gap: several high-skilled professionals retiring soon
- West to East economic shift: rising populations and emerging markets
- Emergence of China as key player in nuclear projects

**Financial and Project Risk**
- Lack of funding for new build projects: large upfront capital investment leads to public to private funding shift
- Lower risk appetite for large projects

**Technology**
- SMR popularity in Canada for remote locations and various applications
- Electrification of transportation and heating and cooling systems

**Other**
- Emerging wave of facilities that are reaching end of life: Pickering, G2
- Shut down of NRU will challenge industry’s ability to supply isotopes and conduct nuclear R&D

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**Policy Balances**

**Maintaining low electricity prices and supporting electrification while achieving carbon reduction commitments**

**How to address diff electricity needs of urban, remote and northern communities: SMR vs. Large CANDU Reactor**

**Encouraging Innovation and New Technologies that satisfy market demand**

**Addressing nuclear concerns (e.g., safety & cost) while maintaining public acceptance**

**Growing a new and sustainable workforce with fluctuating project commitments**

**Leverage international financing (e.g. Chinese) vs. maximizing Canadian jobs through Export Credit**

**Streamlining regulatory requirements while ensuring safety and security**

**Balancing a centralized nuclear strategic policy that meets market requirements**

**Balancing federal (e.g., regulation and R&D) and provincial (supply mix) jurisdiction for nuclear policy issues**
### Natural Resources Canada Levers

#### Legislation and Regulation
- NRCan has authority over Nuclear Research & Development, Uranium resource development and nuclear regulation through the Nuclear Safety and Control Act
- The Canadian Nuclear Safety Commission (CNSC) is the Nuclear regulatory agency and operates independently from the Minister’s authority
- Ability to provide input required for science-based policy making (e.g., Mission Innovation)

#### Funding
- NRCan has a number of funding programs available for industry to support technology development and international engagement

#### Convening Power
- National leadership for provinces and territories on nuclear and energy policy given the separation of jurisdictions
- Ability to bring industry players together to address industry wide-issues and public concerns

#### Information Broker
- Host industry-wide forum for information sharing
- Seeks industry input on government-to-government related issues.

#### International Engagement
- Ability to lead international engagements in collaboration with Global Affairs. E.g., nuclear trade missions & bilateral discussions
- Ability to support industry-led initiatives
- Primary interface with international nuclear agencies (e.g., IAEA)

#### Governance
- CNSC and Atomic Energy of Canada Limited (AECL) are engaged with NRCan via the Minister of Natural Resources.
- Nuclear export control regime governed by Global Affairs Canada & CNSC.

### Actions Requiring Ministerial Attention

#### Nuclear as part of the Climate Change Solution:
- Continue to support Nuclear Initiatives under Mission Innovation and Clean Energy Ministerial Programs
- Play a leadership role among like-minded countries to support the use of nuclear in a low carbon economy

#### Level Playing Field for Nuclear:
- Establish appropriate market measures to incentivize development of low-carbon electricity sources including nuclear. E.g., carbon tax.

#### Acknowledgement of Nuclear’s Contribution
- Publicly acknowledge the merits and contribution that nuclear energy makes
- Address key areas of public concern with science and evidence-based information

#### Funding & Financing
- Identification and allocation of accessible funding for new nuclear technology development
- Allocation of funds for financing nuclear projects (e.g., EDC) and to access export markets

#### Policy & Planning
- Develop centralized strategic policy that supports market needs and industry priorities for R&D
- Federal government, provincial government & industry dialogue for long-term expansion of nuclear fleet and leadership in key areas

### Vision to 2050: Maintaining Tier 1 Status

- Strategic alignment with other Nuclear nations to address trade, environment & disarmament issues
- Embed Nuclear as part of a low carbon future from an international, federal and provincial government policy position
- Enhance public support and social license for Nuclear to underpin consistent policy
- Successfully life extend and operate 10 CANDU Reactors in Ontario
- Build new CANDU reactors in Canada for domestic electricity consumption and export
- Develop and export new CANDU Reactors abroad
- Develop new nuclear technologies
- Deploy and localize SMR technology for remote & non-nuclear applications in Canada
- Sustain and renew R&D facilities in Canada
- Successfully decommission nuclear facilities in Canada and abroad
- Renew the nuclear workforce in Canada
- Be a leader in the nuclear medicine field