



BENEFITS OF NUCLEAR ENERGY FOR CANADIANS

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Prepared by MZConsulting Inc. for the CNA and OCNI



MZConsulting

EXECUTIVE SUMMARY

- Canadians gain many benefits from nuclear technology. It improves the safety of our food, advances our health care, and raises the quality of our lives through clean, reliable, affordable electricity
- The many Canadian organizations that make up the nuclear industry create high quality jobs and bring income to our Canadian communities. This study has assessed the number of jobs created and the impact on Canada's GDP with the following results:
 - The total number of jobs created across Canada is **76,000**
 - The total impact to the Canadian GDP is **\$17 Billion** per year
 - The medical isotope industry with all its benefits to the health of Canadians creates **8,500** jobs

CANADA'S NUCLEAR INDUSTRY

- Canada's nuclear industry is a major source of clean, reliable and economic electricity to Canadians. Its 19 operating reactors (18 in Ontario and 1 in New Brunswick) provide 15% of Canada's electricity
- Canada was one of the pioneers of the modern nuclear energy industry. In 1945 it was the second country in the world to create a sustained nuclear reaction at Chalk River Nuclear laboratories, Canada's national nuclear laboratory
- It is also the birthplace of the CANDU reactor, the only reactor technology other than light-water that has gained international recognition and been exported from its home country to a range of countries around the globe. (Argentina, Romania, India, Pakistan, South Korea and China)
- As a Tier 1 nuclear nation, Canada's industry spans the full nuclear life cycle, from robust nuclear research, to uranium mining, nuclear plant design and supply, nuclear operations and plant decommissioning and waste management

CANADA'S NUCLEAR FUTURE

- Canada has committed to a nuclear future with the life extension of the existing nuclear fleet, which is now scheduled to operate into the 2060s including:
 - The refurbishment at the Point Lepreau site in New Brunswick has been completed and the unit will now operate another 30 years
 - In Ontario, refurbishments have been committed to complete the life extension at the Bruce site and for the Darlington site – an expected spend of \$25 B over the next 15 + years and the Pickering nuclear station life has been extended to 2024
- Following a restructuring of the portion of the industry owned by the federal government, Canada has committed \$1.2 billion over a decade to transform its Chalk River Laboratories (CRL) through the revitalization of essential site infrastructure including new, world-class science facilities
- Canada has attracted significant global interest in the development of a new generation of Small Modular Reactors (SMRs) as a tool in the fight against climate change going beyond traditional generation empowering smaller communities and heavy industry in a low carbon future

FUTURE RISKS

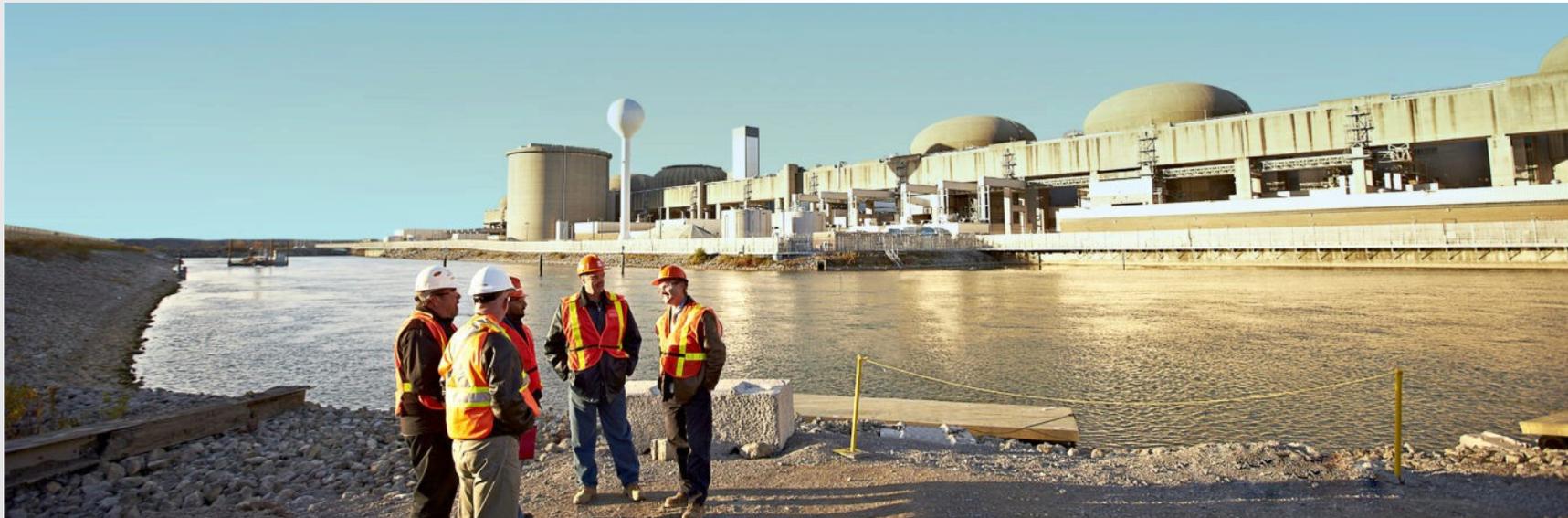
- This industry's future is not assured -- potentially threatening a key strategic technology asset Canada has to fight climate change
- In the absence of any new build, the benefits to Canadians will start to decline
 - In 2024 with the retirement of the Pickering station
 - In 2026 and then in 2033 with the completion of the Darlington and Bruce station refurbishment programs respectively
- With low uranium prices, Cameco has put the world class McArthur River mine into care and maintenance -- keeping only the large Cigar Lake mine in production (requiring a reduction in work force)

THE PROJECT

- MZConsulting has been engaged to update a 2012 study on the economic impact of the nuclear industry to the Canadian economy, including determining the number of jobs created in Canada and the impact on GDP
- The study has 3 parts
 - **Part 1** - Update the current job and income benefits to Canada of the nuclear energy industry
 - **Part 2** - Acquire knowledge of the current economic benefits of the medical isotope industry.
 - **Part 3** - Acquire knowledge of the quality of nuclear jobs and trends in the composition of the nuclear workforce, with particular focus on progress in workforce diversity

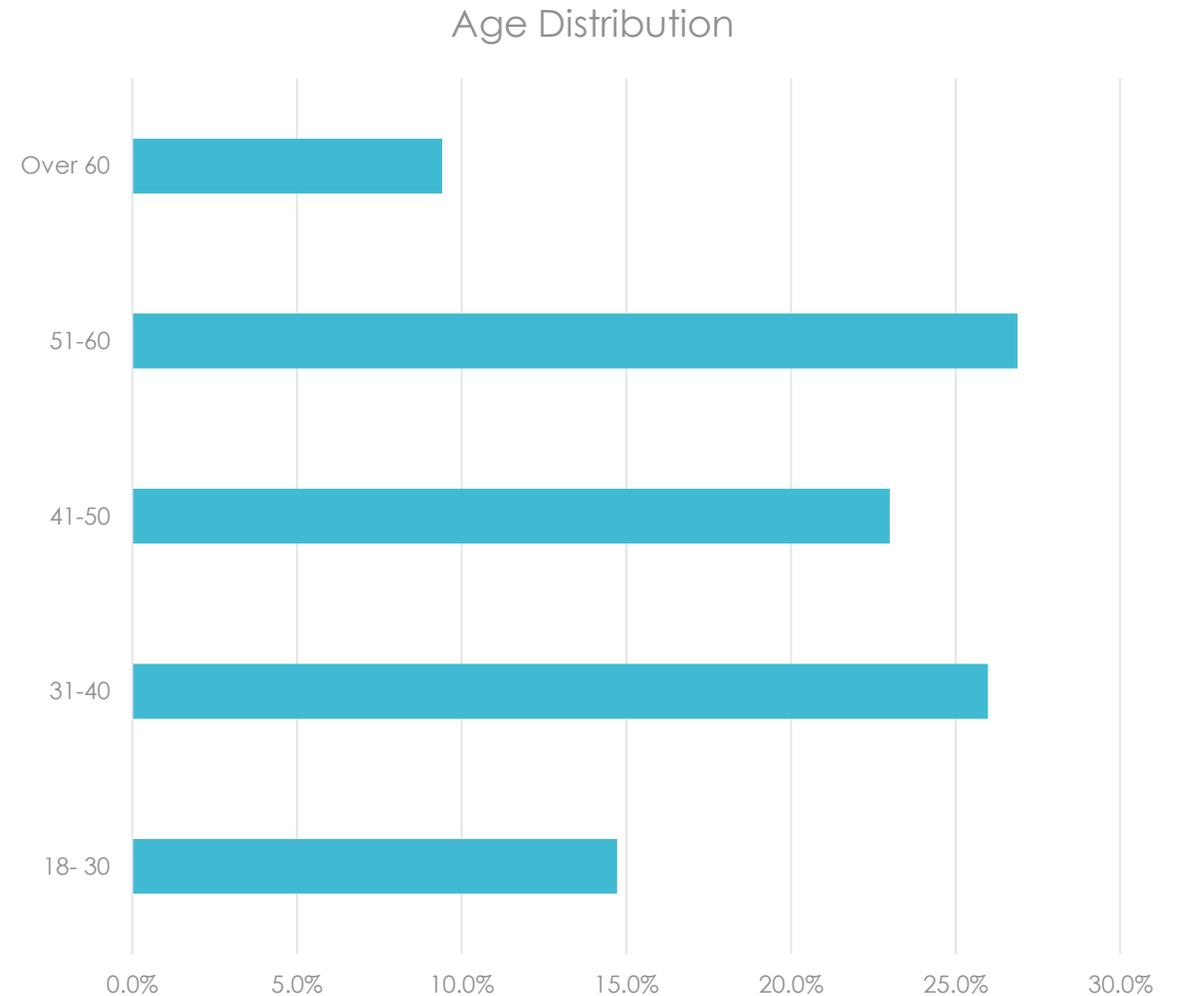
TOTAL JOBS AND GDP IMPACT

- The total number of jobs created by the nuclear industry today in Canada is **76,000**
- The impact on Canada's economy in terms of GDP is **\$17 Billion** per year



JOBS FOR OUR YOUTH

- The common belief this is an industry of older workers is false
- Jobs are well distributed across the age categories with more than **40%** being held by people 40 or younger
- With a third of the work force nearing retirement age, it is expected the industry will continue to create good job opportunities for younger Canadians



JOB QUALITY



- The nuclear industry provides extremely high quality jobs to Canadians with approximately **89%** of the jobs falling into the high job skill category
 - **42%** professional level jobs requiring a university degree or higher
 - **47%** highly skilled technical jobs including the various trades that make up the nuclear workforce

CELEBRATING DIVERSITY

- The nuclear industry has a policy of inclusion. It is working to have at least 30% representation of women by 2030 in positions in which women are currently under-represented.
 - Today the industry consists of **16%** women in the workforce with some larger companies in the 20 to 30% range
- The industry has an Indigenous population of **3%** of its workforce as a whole with a representation of over 40% in the mining sector



THE FUTURE

- The nuclear industry in Canada is currently busy with the refurbishment and life extension of its reactors in Ontario
- The existing benefits will decline over time as:
 - The Pickering station will come out of service in 2024
 - The Darlington station refurbishment will be completed in 2026
 - The Bruce station refurbishment will be completed in 2033
- New initiatives will increase the economic impact of the industry
 - Increasing uranium prices will enable the restart of the McArthur River mine (and then other new mines to follow)
 - New build in Ontario to meet increasing demand and replace retiring stations
 - Potential for small modular reactors (SMRs) to replace fossil generation, support heavy industry and provide a new source of clean energy for the north
 - New nuclear exports supported by a strong industry at home in Canada

MEDICAL BENEFITS OF NUCLEAR

- For more than a half-century, Canada has led the way internationally when it comes to the research, development and production of medical isotopes and pharmaceuticals
- Isotopes are essential components of modern health care, particularly for diagnosis and therapy of various medical conditions and to sterilize medical equipment
- Today there are **8,500 jobs** created in the production of isotopes and in their medical uses across Canada
- The use of isotopes in the medical field is growing rapidly and Canada continues to be a world leader in the field



APPENDIX

STUDY METHODOLOGY

DATA COLLECTION

- Interviews with 8 of the largest companies in the industry (Cameco, CNL, Bruce Power, OPG, New Brunswick Power, SNC Lavalin, BWXT and Kinectrics)
- Electronic survey to remaining CNA and OCNI members with 52 responses representing most of the members with a substantive nuclear workforce. The remaining companies were assessed through assumptions and other sources of input
- The total jobs number represents an accurate count of 95% of the direct nuclear jobs in Canada.
- The detailed analysis had a lower response rate of just under 60% for assessing the number of women and indigenous people in the workforce and about one third for the age distribution
- Data for the isotope business had a high response rate from the industry producing isotopes and a low response rate for the medical community. This has led to an assessment of total jobs only as not enough data was provided to calculate other impacts

ESTABLISHMENT OF MULTIPLIERS

- Multipliers were used to estimate the total impact of direct jobs and spending
- Approach to multiplier selection
 - Review of other studies in Canada, the USA and Europe
 - Reasonableness test against previous Canadian studies
- Multipliers of 2.3 for jobs and 2.3 for GDP were selected and remain conservative

DEFINITIONS AND CALCULATIONS

- Jobs
 - Direct jobs are those jobs in research, mining, at the operating stations and those associated with the nuclear supply chain that identify as "in the nuclear business". This is the same as the 2012 study and consistent with other international studies
 - Indirect jobs are those jobs associated with the supply chain beyond those identified as in the nuclear business supplying staff and materials to the industry
 - Induced jobs are those jobs resulting from additional jobs in communities associated with the spending of people who have both direct and indirect jobs
 - The total jobs are the sum of the above 3 categories and are calculated using a multiplier on direct jobs
- GDP is calculated using the multiplier on end use spends including wages, materials and charity by the three utilities operating nuclear plants, CNL and Cameco. It is assumed that other industry spends are primarily to serve these entities as customers and would amount to double counting.

JOB QUALITY

- The nuclear power industry creates a range of high-quality jobs including a full range of jobs in STEM (science, technology, engineering, and mathematics)
 - Employment includes all disciplines and a range of degrees at the bachelor, masters and doctorate levels
 - Technology jobs provide work at high levels of technical complexity and include skilled trades, quality inspectors, machinists, inspection technicians, and a full range of other technical specialists

COMPANIES THAT PROVIDED INPUT

ABB Inc.	Denison Mines Corporation	Nuclear Waste Management Organization
AECOM Canada Ltd.	E.S. Fox Ltd.	Nuvia Canada
Aecon Nuclear	EnergySolutions	OPG
Alithya Group	Fusering	PCL Industrial Constructors Inc.
AMAG	General Fusion	Promation Nuclear Ltd.
Atomic Energy of Canada Limited	Hatch	RN TOOLING CORPORATION
ATS Automation	IMI NH / IMI-Critical (Newman Hattersley Ltd)	Rolls-Royce Civil Nuclear Canada Ltd.
Black and McDonald	J. A. Plourde Performance Ltd.	RSCC Wire & Cable LLC
Brotech Precision CNC Inc.	Kinectrics	Sargent & Lundy Canada Company
Bruce Power	L3 MAPPS Inc.	Seals Unlimited
Bucephalus Inc.	Laker Energy Products Ltd.	SHAWCOR - Connection Systems
BWXT	Lakeside Process Controls Ltd.	SNC Lavalin
Cameco	Laveer Engineering Limited	SRB Technologies (Canada) Inc.
Canada Metal North America Ltd.	Marshield - a Div of Mars Metal Co.	Stern Labs
Canadian Power Utility Services Limited	MDA	Strategic Policy Economics
CANDU Owners Group (COG)	Moltex Energy Canada Inc	Sulzer Pumps (Canada) Inc.
Central Machine & Marine Inc.	New Brunswick Power	Tetra Tech
CNL	New Era Group	Westinghouse Electric Canada Inc.
CRG Energy Projects Inc.	Nordion Inc.	Worldwide Imaging and Detection Systems Inc.
DB2 Consulting	Nuclear Insurance Association of Canada	WorleyParsons

STUDY TEAM

Study team of

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