Canadian Manufacturers & Exporters

Manufacturiers et Exportateurs du Canada

Nuclear

A Canadian Strategy for Energy, Jobs and Innovation

November 2012

Leadership makes the difference
Le leadership qui fait la différence

CME Studies Economic Benefits of Nuclear in Canada

The Canadian Nuclear Association engaged Canadian Manufacturers and Exporters to verify, update and extend knowledge of the economic benefits of nuclear. CNA values CME's independent economic modelling and research expertise.

The work was carried out from April to September 2012 with cooperation and support from CNA members. CME applied best methods with consistently conservative assumptions throughout the study.

Major themes:

Nuclear is a key and integral part of Canada's innovation, manufacturing and export capacity

Nuclear is a Canadian strategy for energy, jobs and innovation

Executive Summary

Canada's nuclear industry today sustains tens of thousands of quality jobs.

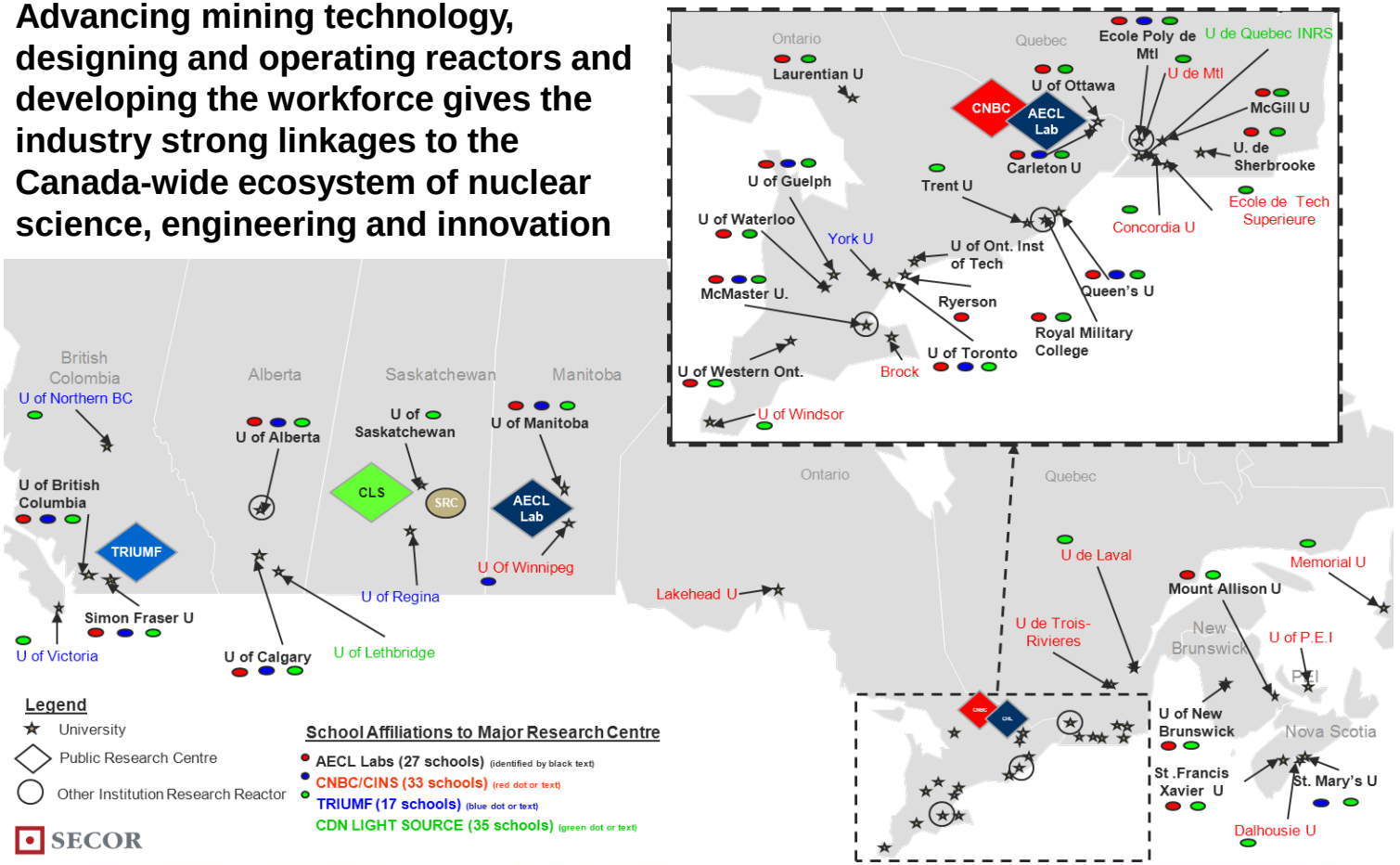
- The industry has the potential to sustain **many more such jobs through 2050 to 2070 and beyond**, if plans for plant refurbishments, new builds, and uranium mine expansion are realized.
- This goes far beyond the employment, supply orders, GDP and tax revenue that these tens of thousands of jobs represent: These expansion and refurbishment plans are **an integrated Canadian strategy for energy, jobs and innovation.**
- Nuclear industry jobs are **long-lasting** (5 to 50 years), **well-paid** (averaging about $100,000/yr), and **knowledge-rich** (with excellent training and development).
- Nuclear is also **part of our national science and innovation system**, involving over 30 universities and six major research centres.
- Employment at Canada's uranium mines is over 45% **Aboriginal** and nearly 50% **northern residents,** and the mines are expected to **double production** over the next five years**.**
- Nuclear energy's **minimal emission profile** helps Canadians meet our clean air goals.
- Sufficient **affordable electric power** is both a benefit to ratepayers, and a core advantage for Canada's economic growth.

Canada has the opportunity to sustain and grow all these benefits through the 21st century

Our Commercial Nuclear Assets

Part of our Science & Innovation System

Advancing mining technology, designing and operating reactors and developing the workforce gives the industry strong linkages to the Canada-wide ecosystem of nuclear science, engineering and innovation



Where the Jobs Are

- **Uranium exploration (several provinces and territories)**
- **Uranium mining (sites in northern Saskatchewan – major employers of Aboriginal Canadians)**
- **17 nuclear power reactors (capacity ratings vary)**
  - Eight at Bruce Power, Tiverton (Huron County), ON
  - Four at Ontario Power Generation's Darlington site, Clarington, ON
  - Six at OPG's Pickering site, Pickering , ON
  - One at NB Power's Point Lepreau site, NB
- **Refurbishments planned for 10 of 17 operating reactors**
  - Other reactors are already in their second (post-refurb) operating life.
- **Two new nuclear power reactors planned at Darlington**
- **Research reactors, laboratory & testing organizations etc.**
  - AECL Nuclear Laboratories, Kinectrics/Candesco, universities, CLS, TRIUMF
- **Nuclear medical businesses and organizations**

The economic impact of most of these industry elements is analyzed directly in the CNA-CME Studies of Nuclear Power and Mining

Nuclear Jobs Last

Mining industry jobs: 10,000++ indefinitely

(resource is very high quality and large; will remain competitive for decades; growth likely)

Operating plants: 19,000+- until about 2050

(assuming full refurbishment program in Ontario plus Darlington new build)

Refurbishing plants: 10,000+ for about 11 years

(assuming ten refurbishments in Ontario Long Term Plan – but not Gentilly-2)

Building new plants: 21,000+ for about five years

(assuming two full-sized reactors at Darlington with majority Canadian content)

Notes: All assumptions are conservative, including 1:1 relationship of direct to secondary employment. Figures exclude nuclear-related jobs outside mining and power sectors (i.e. medicine, universities, research laboratories, standards and auditing organizations). Figures also exclude employment in the plant shutdown/decommissioning process. No assumption about new build other than Darlington, such as CANDU units outside of Canada or small modular units, which would materially increase employment.

Nuclear Jobs Learn

This is a high-knowledge, high-innovation industry.

The industry's large number of highly qualified personnel (HQP) create formative training and work-experience opportunities for other workers. They also transfer knowledge and skills into other Canadian workplaces when they change employment. This drives innovation and adoption of best practices, and enriches the knowledge and skills of Canada's entire workforce.
An electrical control system supplier: *"Nuclear's just two percent of our revenue, but it* ***drives our whole company to meet high standards, learn best practices and pass quality audits. That's worth a lot more.****"*

This industry invests heavily in employees. Some illustrations:

A reactor component firm*: "We do all our workforce development in-house; our industry has lots of proprietary knowledge, and a culture of training.* ***We spend a bigger share of revenue on our people than most companies do.*** *Jobs from subsidizing renewable energy are said to be high-quality, but they don't come close to ours in terms of* ***durable skills and capabilities.****"*
Major uranium mining firms: "*Cameco has provided $2 million in funding toward Credenda Virtual High School, a live, web-based program that gives students in remote northern areas access to math and science courses. AREVA provides over $130,000 in annual scholarships such as the Northern Saskatchewan Scholarship Program, while Cameco offers more than $300,000 per year in direct support for students. AREVA has sponsored the Mining Engineering Technology program at the Saskatchewan Institute of Applied Science and Technology (SIAST); the company provided $100,000 to support SIAST in educating new workers for the industry*."

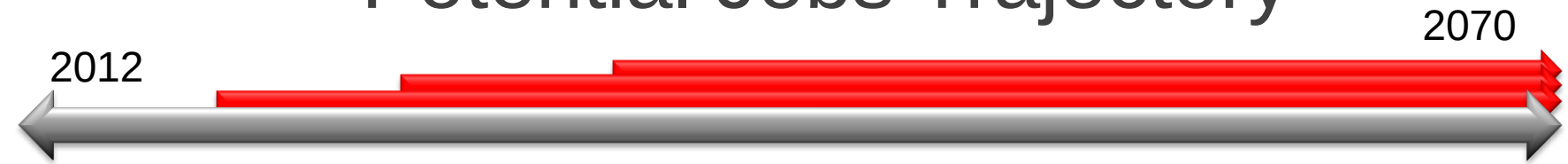
Nuclear Jobs Pay

Average salary of direct employees in Canada's nuclear industry is approximately $100,000.

Illustrative Company	# Highly Qualified Personnel	Avg Salaries – HQP vs Others
Company A	227	$141,711 / N/A
Company B	2,000	$130,000 / 85,000
Company C	160	$130,000 / 90,000
Company D	1120	$159,000 / 88,000

Note: Salary figures do not include investments in employee benefits or workforce development.

Potential Jobs Trajectory

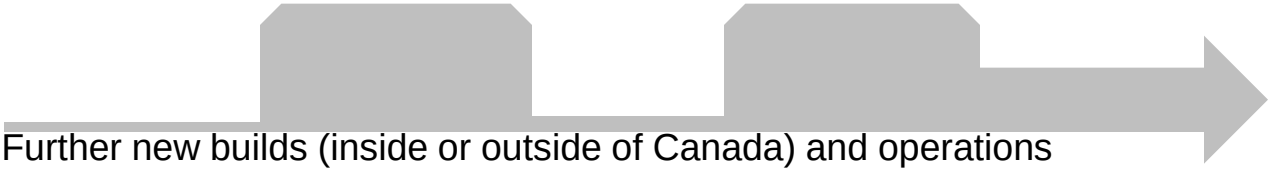


Mining: 10,000++ Strong growth is likely due to good resource base and opening export markets.

Operating plants: 16,000+ Given refurbishments, these jobs will last at least to mid-century.

Refurbishing ten plants: 10,000+ Currently planned program would last about 11 years.

Build takes about five years, with refurbishment around mid-century.
Building two new reactors: 21,000+



Further new builds (inside or outside of Canada) and operations

Calculated in CNA-CME study 

More Than Direct Jobs

Building a new, full-sized, two-reactor plant requires:

- 400,000 cubic meters of concrete
- 20,000 tonnes of steel
- 700 kilometres of wiring
- 70 kilometres of piping

Uranium Mining in Saskatchewan

Total value of goods & services purchased:	**$1.08 billion**
• 75% of total spent in Saskatchewan	
• 43% of total spent in Northern Saskatchewan	
Paid to Province of Saskatchewan:	**$145.9 million**
• Paid to local governments	$5.9 million
• Licensing fees	$6.3 million
• Surface Lease Fees	$12.1 million
• Donated to community & charity	$4.5 million
• Scholarships	$340,500
Contributions to government (via direct hires):	**$133.2 million**
• Income Tax	$111.1 million
• Canada Pension Plan	$15.9 million
• Employment Insurance	$6.2 million

Annual Benefits of Refurbs and Operations

Combining 10 Refurbs and All Operations
During the Refurbishment Program Period

	Refurbishment	Operations	Total Impact
Employment	10,636	16,640	27,276
Labour Income	$1,248 m	$2,073 m	$3.3 b
Fuel Cost	Not Applicable	$518 m	$518 m
Equipment, materials and supplies	$1,890 m	$1,241 m	$3.1 b
TOTAL	**$3.1 b**	**$3.8 b**	**$6.9 b**

Includes ongoing operation of the plant at Point Lepreau, NB. Does not include operations at the new-build Darlington plant (which will raise the impact in the “operations” and “total impact” columns), as operations might not occur during the 11-year period considered. Does not include refurbishment or ongoing operation of Quebec’s Gentilly-2 plant (which would further raise the impact in all columns).

Annual Economic Impact of Building a New Full-Sized, Two-Reactor Nuclear Power Plant

	Direct Impact	Secondary Impact	Total Impact
Employment	10,800	10,800	21,600
Labour Income	$799m	$1.12b	$1.92b
Equipment, materials & supplies	$1.38b	$1.52b	$2.90b
TOTAL (Annual for five years)	**$2.18b**	**$2.64b**	**$4.82b**

Economic Impact in Canada of Building a Nuclear Power Plant Abroad

Parameter	Total Capital Cost (C$ Million)	Canadian Content	Impact in Canada of Building Two Enhanced CANDU 6 (EC6) Reactors	Person Years of Work in Canada
Project management	$1040 m	20%	$208 m	460
Engineering and procurement	$960 m	76%	$729 m	1824
Equipment	$2380 m	69%	$1642 m	*
CANADIAN IMPACT			$2.57 BILLION	>2284

Duration of work is 66 months from first concrete to unit 2 being in service.
Capital costs are expressed in 2012 dollars and are overnight, i.e. excluding escalation.
*While equipment manufacture presumably generates significant economic impact in Canada, insufficient data were available to estimate this figure reliably.

Cost, Employment and Schedule for a New Small Modular 2-Reactor Plant

Parameter	2 x 180MW Modular Reactors
Engineering and procurement	$1.6 billion
On-site labour cost	$ 400 million
Direct employment	2,400 person-years
Schedule (Duration of physical works)	3 years

Local content assumption: 20% for engineering and procurement (net $320 million), 90% for on-site labour (net $360 million). $320M + $360M = $680M expenditure in Canada over three years, or **$226 million and 800 jobs annually** for three years.

A Canadian Strategy for Energy, Jobs and Innovation

Nuclear power has a 50-year track record of delivering **affordable clean air energy** to Canadians.

These growth plans are **an integrated Canadian strategy for energy, jobs and innovation.**

Nuclear is an integral **art of our national science, technology, engineering and innovation system.**

Nuclear is a **major employer of Aboriginal Canadians and northern residents**.

Nuclear industry jobs are **long-lasting**, **well-paid**, and **knowledge-rich**.

Canada has the opportunity to sustain and grow all these benefits through the 21st century.

Thank you

For more details and methodology:

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