Neutrons Canada

Investing in Sovereignty of Capability

World-leading Canadian research with neutron beams advances nation-building priorities

DEFENCE
Longer-lasting energy storage for mobile forces, radiation-reliable satellites, quantum-safe communications, and life-extension of our navy fleets can all be advanced with dual-use research.

CRITICAL MINERALS
Extracting critical minerals from primary ores to secure supply chains; Developing new materials that reduce or eliminate critical minerals in key technologies to mitigate Canada's dependence.

ENERGY SECURITY
Developing and testing fuels and materials for Small Modular Reactors, ensuring safety and reliability through precise knowledge of their behaviour in a reactor and long-term storage.

TECH LEADERSHIP
Quantum materials research underpins the development of quantum computers, sensors, cryptography and other leading quantum technologies.

Neutrons Canada can help accomplish nation-building priorities by channeling investment in vital research infrastructure, research and development, and leading researchers.

Canada's ability to support these research priorities is challenged by the 2018 closure of Canada's primary neutron source, at a time when other G7 nations were investing in neutron sources and operation of programs for research with neutron beams. (See Table 1) Since 2018, over 90% of Canadian neutron users have faced strong barriers against accessing alternate sources in other countries. Now, Canadian researchers increasingly avoid research that needs neutron beams. The qualified workforce is at risk.

Table 1 - G7 Investments ($B CAD) in Nuclear Power, Neutron facility upgrades and operating costs, in the 21st Century

Country	Major Neutron Sources	Scale of Nuclear Power Industry	Neutron-beam Facility Upgrades	Neutron-beam Facility Operating Costs
United States	SNS, NCNR, HFIR	109	3.1	0.40
Japan	J-PARC, JRR-3	38	3.4	0.19
Germany	FRM-II, BENSC (Berlin); Contributions to ILL, ESS	20 (until 2011)	1.4	0.14
United Kingdom	ISIS; Contributions to ILL, ESS	10	0.7	0.10
France	Institute Laue Langevin (ILL); LLB; Contribution to ESS	66	0.6	0.08
Italy	Contributions to ILL, ESS, ISIS	0	0.2	0.01
Canada	NRU until 2018	20	0.0	0.02

Building on several years of consultations across Canada and internationally, the research community has articulated its national vision for rebuilding Canadian capabilities and seizing emerging opportunities in the *Canadian Neutron Long-Range Plan (LRP) for 2025 to 2035*. The LRP is centred around a comprehensive program that will enable Canadian students, scientists, and engineers to address scientific, social,

environmental and economic challenges by providing access to versatile and irreplaceable neutron-beam research tools. Investment in this program will demonstrate Canada's commitment to empower Canadians to work at the cutting edge of world-class materials research with a complete toolkit including neutron-beam methods. It will also help to build the human capacity and experience needed for Canada to maximize the outcomes of a future $2B investment in a multipurpose research reactor that will also produce medical isotopes and perform vital materials testing for the nuclear power sector.

Meanwhile, the LRP calls for the Government of Canada to allocate $95M over a 6-year period, and an ongoing baseline support of $25M per year for a national neutron-beam program that includes 3 missions:

1. Facilitating Canadian participation in world-leading neutron sources (47%);
2. Building and operating domestic capabilities, including the neutron beam lab at McMaster (42%); and
3. Developing new neutron sources in Canada for the long term (11%).

To govern and manage this program, Canadian universities created Neutrons Canada in 2022 as a not-for-profit corporation whose membership is comprised of 16 research institutions across the country. Neutrons Canada has the national perspective and specialized knowledge of the neutron beam field to channel the requested investment to maximum effect across the 3 missions through a comprehensive portfolio of activities including investment in capital and operation of neutron-beam infrastructure, creating partnerships with European and American facilities, developing innovative neutron-beam methods and expanding the workforce of qualified people for materials research with neutron beams.

As a paying client, Neutrons Canada will ensure that major international neutron beam facilities and the modest neutron beam facility at the McMaster Nuclear Reactor are accessible to all Canadian researchers and are responsive to Canada's needs. In turn, Neutrons Canada will maintain a watch on the needs of Canadian researchers through a cooperative partnership with the Canadian Institute for Neutron Scattering, which represents the neutron-beam user community.

Investing in research with neutron beams returns more than 300% in social, environmental and economic benefits [1]— and Canadians are leaders in realizing such impacts.

EXAMPLES OF IMPACTS FROM NEW KNOWLEDGE REVEALED BY NEUTRON BEAMS

ACCELERATED UPTAKE OF ELECTRIC VEHICLES (EVs)

The present value of economic benefits to Canada, cumulative to 2030, attributable to research with neutron beams is estimated at $1.6 billion, based on a conservative estimate that the research accelerated the development of EVs by just two years.

COMPUTER HARD DRIVES

Canada has realized at least $800 million in economic benefits attributable to neutrons from accelerated hard drive development.

CLEAN ENERGY PRODUCTION

Canada's nuclear power stations have avoided losses of hundreds of millions of dollars and prevented gigatons of carbon dioxide emissions.

SUSTAINABLE FOOD

Daiya Foods, the top Canadian brand of plant-based cheese, launched new products in 2023 and 2024 resulting from a partnership with researchers who use neutron beams.

PUBLIC SAFETY

Canadians enjoy safety from improved, evidence-based regulations for airplanes, pipelines, and railroads.

[1] These impacts, and many others, are documented on our website with explanations of the calculations of return on investment based on international studies: https://neutrons.ca/#impacts