

Canadian Light Source Submission to the House of Commons Standing Committee on Finance Priorities for the 2017 federal budget

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Introduction

The Canadian Light Source (CLS) is one of Canada's most important large scale national infrastructure science investments. The brightest light in the country—millions of times brighter than even the sun—the CLS is used by scientists to get incredibly detailed information about the structural and chemical properties of materials at the molecular level.

The CLS is one of the largest science projects in Canadian history. It has hosted over 3,000 researchers from academic institutions, government, and industry from 28 countries, and 10 Canadian provinces and 2 territories; received almost 12,000 user visits; and provided a scientific service critical in over 3,000 scientific publications.

The over 1,000 scientists that use CLS per year, will continue to add to the knowledge base already fueled by the CLS, including:

Environment:

- New understanding of long-term predictive behavior of heavy metal contaminants in a uranium mine, ensuring tailings safety for years to come.
- Revealed new high efficiency catalysts for petroleum refinement which outperform benchmarks in the \$16 billion catalysis industry.ⁱ

Health:

- A new way to produce medical isotopes without a nuclear reactor, resulting in the creation of CLS's first spin-off, the Canadian Isotopes Innovation (CII) Corporation. This is the first commercially viable alternative to conventional reactor-based production. In Canada alone, isotopes are used in 5,500 medical scans a day, and current supply centres are scheduled to shut down in the near future.ⁱⁱ
- A new protein that converts A and B blood to a universal type, which could be donated to those needing any blood type. Half of all Canadians will either need blood or know someone who will need blood at some point in their lives.ⁱⁱⁱ
- Developing chemical signature cancer detection techniques, enabling earlier detection and potentially new treatment avenues for various cancers.

Agriculture:

- Discovered the cause of wheat resistance to scab, a fungus which renders wheat inedible and which can affect up to 50 per cent of crop yields in affected areas. Economic losses due to scab in Alberta between 2010 and 2012 alone are estimated at over \$15 million dollars.^{iv}
- Identified key causes for temperature resistance in peas, which will help breeders develop more heat-tolerant strains of the crop.

Advanced materials:

- Discovered key behaviours of high temperature superconductors, providing key insight into the development of room-temperature superconductors. Superconducting electrical lines eliminate all energy transmission losses in power grids, which currently make up 7 per cent of all Canadian electrical output.^v
- Developed technique to produce platinum nanocrystals under environmentally friendly conditions and without reducing agents. The nanocrystals are used in industrial applications

from fuel cells to hydrogenation processes, higher-stability and –efficiency chemical reactions at higher efficiency than traditional options.

Federal measures that would help Canadians maximize their contributions to the country's economic growth

Research and development investments are essential to the generation of new ideas, technologies and products that enable Canadian industry to capture and hold world-leading market leadership. The government has an important role in the innovation cycle by sharing the cost and distributing the risk of research and development, particularly at a time when financial resources from private sector and academic sources are constrained. By supporting government / industry / academia partnerships, the government can leverage current and future investments and broaden collaborations along the value chain.

1. It may be appropriate to consider further expansion of programs like the National research Council's Industrial Research Assistance Program (IRAP)—both in terms of available funding to enable technology development and its transfer to the private sector. This could well extend the benefits of technology partnership programs to more businesses, enhance opportunities to create additional SMEs focused on innovation and further facilitate access to Canada's research infrastructure.
2. The eligibility criteria for Industry Canada's flagship R&D partnership program, the Strategic Aerospace and Defence Initiative (SADI), could be broadened to again include "Enabling Technologies", which would accommodate new investments in research and innovation across the Canadian economy.
3. Also, the Industrial and Regional Benefits Program (IRBs) could be more directly targeted to encourage innovation by requiring that a minimum proportion of IRB commitments be specifically directed at research and development initiatives undertaken through industry / public research consortia.
4. Canada should work towards becoming a leader in R&D investments, both through funding projects, industry-academic collaborations, as well as building and maintaining world-class scientific infrastructure. An important component of innovation is large scale science infrastructure, which cannot be borne by a single institution or entity. These large institutional investments can enhance the future competitiveness and innovative capacity of home-grown industries and broaden opportunities for international collaboration and market presence.
5. Building academia-business sector consortia around large national science infrastructure would also help leverage the investments made. These facilities, like the CLS, play an increasingly important role in technology transfer and collaboration. They have become a crossroad for industry, government and academic research ideas and innovation – a cluster in which shared knowledge can converge, be challenged and advanced.

Federal actions to assist Canada's businesses meet their expansion, innovation and prosperity goals, and thereby contribute to economic growth in the country.

A robust and vibrant basic research environment will make Canadian universities and research institutes attractive to the best and the brightest scientists, engineers and technicians in the world. The Canada Research Chair Program has been very successful in advancing this goal.

A number of federal government investments have greatly improved Canada's research infrastructure, including the creation of the Post-Secondary Institutions Strategic Investment Fund in the last federal budget and previous investments in the Canada Foundation for Innovation. These investments contribute to the establishment of world-leading research infrastructure. One of the essential requirements to attract leading scientific and engineering talent is access to state-of-the-art research and development infrastructure, such as the Canadian Light Source. In our view, it is imperative to ensure their long-term sustainability as a magnet for international talent and as an anchor for domestic expertise.

1. Given the competition for world-leading research talent, it may be appropriate to consider a specialized immigration initiative for highly skilled scientific and engineering personnel. Such a dedicated stream exists for academic appointments, but not for scientific staff at national research facilities. Additionally, by facilitating entry to Canada for graduate and post-doctoral students, talented young people would be encouraged to stay in Canada.
2. The Scientific Research and Experimental Development (SR&ED), is an important vehicle to encourage private sector investment in R&D. A simplification of the qualifying criteria for access to SRED should result in more widespread use of these incentives. The re-introduction of capital as eligible expenditures will assist in encouraging industry investment in Canadian research infrastructure.
3. The Canada Foundation for Innovation infrastructure funding programs are well defined to fund new research and innovation at universities. However, it is not clear that 40% federal funding limit is suitable for large scale science infrastructure used by researchers from across Canada. Negotiating the provincial matching contributions from multiple provinces, as well as seeking matching investments from industry and other private is time consuming and difficult. Consideration should be given to more comprehensive contributions to these facilities.

Federal measures to ensure communities throughout Canada enable businesses to expand, prosper and serve domestic and international customers in order to contribute to growth.

It is very important to leverage existing investments in scientific infrastructure. As an example, large capital investments have been made in Canada's leading edge national science facilities, and this has been recognized and addressed through the design of a dedicated system to fund their long-term operations.

1. The Canada Foundation for Innovation's Major Science Initiatives (MSI) program, created in 2010, has been crucial to maintaining Canada's large scale science infrastructure operating. MSI funding not only represents a major portion of CLS operating funding, it has also historically been the catalyst for contributions from other entities. However, the complicated funding matching structure of the current funding mechanism is not sustainable, and has caused several large scale science organizations to operate under significant restrictions. This compromises facilities' ability to remain state-of-the-art, and internationally competitive. Unquestionably, ensuring the long term sustainability of these facilities is key to Canada retaining its status as a world leader in discovery-driven research. Equally important is to continue to reinvest in capital infrastructure so that these facilities remain state-of-the-art.
2. The Government of Canada's suite of programs designed to best support research excellence should include funding to address capital needs and upgrades, as well as long term, secure, and robust operating funding for national research facilities like the CLS.
3. Funding programs like IRAP and SADI are examples of efforts that have been successful in bridging gaps between public research and private commercialization. Expanding these and other programs

would encourage partnerships with provincial programs and further extend benefits to business, enhance the creation of SMEs, and facilitate their access to Canada's research infrastructure.

4. The Industrial and Regional Benefit program (IRB) could also be modified to play a larger role in encouraging innovation, by requiring a portion of the IRB funds to be specifically directed at research and development through industry/public research partnerships. This would encourage IRB obligors to invest in innovation, thereby further supporting the future competitiveness of Canadian businesses and research institutions.

Contact information:

Sandra.ribeiro@lightsource.ca on behalf of the Canadian Light Source Inc.

Ph: 306-657-3558

ⁱ http://iic.pnnl.gov/news/transformations/value_catalysis.stm

ⁱⁱ <http://marker.to/BwLvIS>

ⁱⁱⁱ <https://www.blood.ca/en/blood>

^{iv} <http://www.agannex.com/field-crops/the-economic-impact-of-fusarium-in-alberta>

^v <http://www.cap.ca/en/article/superconductivity-advances-and-prospects> & <http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS>