UNIVERSITY OF CALGARY

SUBMISSION FOR THE PRE-BUDGET CONSULTATIONS IN ADVANCE OF THE 2020 BUDGET

- Recommendation 1: That the federal government establish a $200 million annual **Clean Future Research and Innovation Fund** that invests in university research focussed on new discoveries that support climate change mitigation and adaption, while enhancing talent development, knowledge mobilization and commercialization.

- Recommendation 2: That the federal government establish a $2 billion **Green Campus Investment and Innovation Fund**, which will provide grants to universities to enhance campus energy efficiency through upgrades to facilities, and where feasible, support the ability to pilot pre-commercial technologies offering greenhouse gas (GHG)-reducing or climate change-mitigating impacts.

- Recommendation 3: The federal government **enhance its support for the research enterprise** by increasing its investments in fundamental research, by providing funding to address the full costs of research and knowledge mobilization efforts, and through funding for major capital projects, including cybersecurity infrastructure.

- Recommendation 4: The federal government should act to **improve Indigenous student access** and success at university by increasing direct financial support for First Nations, Inuit, and Métis students and by funding support programs (e.g. housing, daycare, cultural centres, and employment services).

The University of Calgary: Embracing a Low-Carbon Future

The University of Calgary (UCalgary) would like to thank the Standing Committee on Finance for the opportunity to share its priorities in advance of the 2020 federal budget.

As one of Canada's premiere energy research universities, UCalgary is a unique and invaluable partner for the federal government in its efforts to slow and mitigate the effects of climate change. The university is contributing to Canada's climate change goals in several ways.

Through its Global Research Initiative in Low Carbon Unconventional Resources (GRI) and a "confederation of scholars" approach, UCalgary has developed a world-class, interdisciplinary energy research program that is developing the talent, fostering the public policy, and creating the technologies needed to address the challenges of climate change. In 2012, UCalgary developed an institutional research strategy focussed on a low-carbon future. Today, GRI encompasses over 30 projects searching for ways to store or convert CO_2 to other forms of energy; technology to detect and prevent methane emissions, and; methods for generating electricity from hydrocarbon reservoirs, while leaving CO_2 underground. In addition, our scholars are working on policy development and regulatory measures. Over 270 faculty are involved in these programs, and they supervise more than 1,500 graduate students and 110 postdoctoral scholars.

Second, UCalgary's entrepreneurial ecosystem has a track record of commercializing energy efficient and low-carbon technologies. The Hunter Hub for Entrepreneurial Thinking has helped student and faculty business ideas develop into viable concepts, the Creative Destruction Lab-Rockies has helped over a dozen clean-tech companies (many of them UCalgary spin-offs) evolve to the point of commercial viability, while Innovate Calgary has patented and licensed hundreds of novel technologies in recent years.

Finally, the university, through its network of scholars and alumni, and its government and community partnerships, advances the public dialogue on Canada's response to climate change and informs those debates through its research and teaching.

Canada's transition to a low-carbon future will not occur overnight. Canadians will only adopt low-carbon sources of energy that are competitive with, and offer the same convenience, flexibility, reliability, and portability as hydrocarbons. While the federal government can use regulatory tools to accelerate this shift, it also has fiscal tools that can encourage clean energy research, ensure that the resulting research is commercialized, and importantly, that Canadians adopt the resulting technology.

Facing Climate Change: Spurring Innovation

We must equip future generations with the necessary knowledge, skills, and tools to meet and address the climate change challenge. UCalgary is taking action to meet Canada's clean energy needs. UCalgary focuses its energy research activities on minimizing the environmental cost of developing unconventional hydrocarbons; on researching and developing cost-competitive, low-or-zero carbon energy sources, and; on measuring and addressing the cumulative effects of energy-related processes. Some high-potential UCalgary projects include:

- Zero-carbon hydrogen production from heavy oil reservoirs: UCalgary researchers, in partnership with Proton Canada, have developed a technology to conduct *in situ* gasification of heavy oil and bitumen that yields pure hydrogen at surface without producing oil or CO_2.

- Carbon-negative oil production: UCalgary is piloting direct air capture (DAC) coupled to CO_2 enhanced oil and brine recovery (CO_2-EOBR). The pilot will test the possibility that combining DAC and CO_2-EOBR can be carbon negative and energy positive. That is, the process removes more CO_2 from the atmosphere than is released when the oil is processed and burned, and that the oil releases more energy than is needed to capture the CO_2.

- Advanced solar technology that uses energy from sunlight to convert CO_2 to natural gas, while producing renewable electricity and pure oxygen. The technology combines algae with organic solar cells, and is being tested at pilot scale.

These projects all have the potential to dramatically impact Canada's GHG emissions while generating commercially usable energy. This sort of innovation will help Canada meet its climate change goals, while creating jobs and growing the economy.

Accordingly, UCalgary joins its U15 colleagues in recommending that Budget 2020 establish a $200 million annual **Clean Future Research and Innovation Fund (CFRIF)**. CFRIF will invest in climate change mitigation and adaptation research with the potential to create new business and employment opportunities. CFRIF will combine the research strength of Canada's universities with strategic investments in talent development, knowledge mobilization and commercialization.

Projects funded by CFRIF should have the potential to help Canada mitigate or adapt to climate change. CFRIF should have two streams:

- *Foundational Knowledge Stream*. Projects funded under this stream should address the technical and social aspects of specific climate change mitigation and adaptation challenges and opportunities. These projects will fill gaps in our knowledge and explore promising early-stage climate solutions. Given the complexity of the climate change challenge, these projects will typically involve multi-disciplinary teams and non-academic partners.[1]

- *Innovation Acceleration Stream.* The Innovation Acceleration Stream will provide research teams with resources to demonstrate the applied potential of the ideas developed in the Foundational Knowledge Stream. This stream will also provide resources for entrepreneurship training. The proof-of-concept funding will allow teams to turn basic research into working solutions. We recommend that the government model the CFRIF's entrepreneurship training component on the I-Corps program from the United States.[2]

[1] U15 2020 Pre-Budget Submission.
[2] Ibid.

In addition to the quality of the proposed research, CFRIF should weigh each proposal's potential to have large-scale and long-term effects on Canada's climate change efforts, the opportunities it offers to grow talent, and participation by key non-academic stakeholders when making funding decisions.

Facing Climate Change: Deploying Solutions

UCalgary is a leader in reducing its environmental footprint and developing (and implementing) GHG-reducing retrofits that are applicable to the federal government's portfolio of similarly aged buildings and to Canada as a whole. UCalgary has done this in three ways: by building new utilities, renewing existing ones, and by deploying incremental technologies.

- New utilities: in 2009-10, the university commissioned a $60 million combined electricity generation and district heating plant that has reduced GHG emissions by 60,000 tonnes per year between 2008-09 and 2014-15, while the campus grew in size by 17% (or 140,188 m^2).

- Renewing assets: the MacKimmie Complex Redevelopment project – which will transformation a 1960s tower into a Canada Green Building Council's Net Zero Carbon facility – uses advanced heating and cooling systems to reduce energy use by 90% in a 32,000 m^2 building.

- Incremental technologies: the university is embracing existing technologies through its Utility Reduction Program – a multi-year effort to deploy photovoltaics, lighting controls, energy recovery systems, and upgrades to the district heating system across the university – which has reduced annual emissions by 8,000 tonnes to date, while saving on annual utility costs.

These activities are part of UCalgary's broader sustainability strategy, which has helped the university receive multiple STARS gold ratings from the Association for the Advancement of Sustainability in Higher Education.

UCalgary plans to decarbonize its campus, reducing its GHG emissions to 97% below 2008 levels by 2050. The university will accomplish this by replacing old facilities, retrofitting existing buildings, and embracing new technology. But to meet this goal, and to continue to develop technical solutions, UCalgary needs a reliable partner with a long-term vision. As such, we join our U15 colleagues in recommending that Budget 2020 include a $2 billion **Green Campus Investment and Innovation Fund (GCIIF)** to finance projects that decrease Canadian universities' GHG emissions.

GCIIF should include an **Innovation Acceleration Supplement**. The Supplement will encourage universities to be lead customers for new products and services. The Supplement will also allow universities to treat their campuses as learning labs, where students and researchers participate in the installation and operation of new equipment, and use that experience to inform their education and research agendas. Involving students and researchers in the deployment and testing will help train our country's next cohort of clean-tech workers by giving students hands-on experience.

Facing Climate Change: Committing to Fundamental Research

To maximize CFRIF's effect, the federal government should continue building on its commitment to support fundamental research at Canada's universities. Specifically, this means increased support for the tri-councils, addressing the outstanding costs of research issue, and investing in knowledge mobilization.

A commitment to fundamental research should include funding for cybersecurity research and infrastructure. Wireless measurement and real-time monitoring hardware (i.e. the Internet of Things, or IOT) have become important tools in the fight against climate change. IOT systems help firms optimize their activities, detect emissions, and generate invaluable data. However, they need to be safe from interference. Canada's universities are already working on ways to secure the industrial IOT, but more work is necessary. Likewise, Canadian universities need to be confident that their own research assets, data, and intellectual property are secure against criminal meddling and theft. Hardening Canadian universities' digital infrastructure is essential.

Finally, predictable research funding allows Canada to work with international researchers. Universities Canada has found that 83% of universities cite a lack of funding as a serious barrier to international collaboration.[3] Given the magnitude and global nature of the climate change challenge, Canada must be a participant in worldwide research networks. Sitting on the sidelines could mean losing access to crucial ideas, talent, and technology.

Ultimately, universities conduct applied research and commercialize technology on a foundation of fundamental research. The federal government should continue its efforts to ensure that foundation is solid.

Facing Climate Change: Ensuring the Success of Indigenous Students

UCalgary also recommends, along with our colleagues at Universities Canada, that the government act to increase access to university for First Nations, Inuit, and Métis (FNIM) students. To thrive in the face of climate change, Canada must ensure that every Canadian has the tools they need to meaningfully participate in our society and economy.

Furthermore, some of climate change's effects – such as forest fires, floods, and droughts – particularly harm rural, agricultural, northern, and remote communities. FNIM Canadians are more likely to live in rural Canada than their non-Indigenous counterparts, and ensuring that FNIM Canadians have the skills, knowledge, and experience to implement climate change adaptation programs in their home communities is essential for the welfare of Canada's Indigenous citizens.

Accordingly, UCalgary recommends that the federal government take action to ensure that financial barriers do not prevent FNIM students from attending university, and that once they are enrolled, that they have access to the social, employment, housing, and cultural services (such as UCalgary's Writing Symbols Lodge) they need to maximize retention and graduation rates.

[3] Universities Canada 2020 Pre-Budget Submission.

Conclusion

As one of Canada's leading energy research universities, UCalgary is making significant efforts to research, commercialize, and deploy low-carbon and alternative energy technology. This submission's proposals – that the federal government invest in fundamental and applied research, in green infrastructure, and in talent – will allow the UCalgary to accelerate and scale those efforts.

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