



CMC Research Institutes

Pre-Budget Submission

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About CMC Research Institutes

CMC Research Institutes design, create and operate clusters which catalyse and deliver multi-sector innovation to eliminate industrial greenhouse gas emissions.

Carbon Management Canada, Inc. was incorporated in 2009 to advance technologies and insights that would radically reduce carbon emissions from large stationary industrial emitters. The organization awarded \$22 million to a portfolio of 44 research projects and supported 155 researchers and over 200 graduate students and postdoctoral fellows.

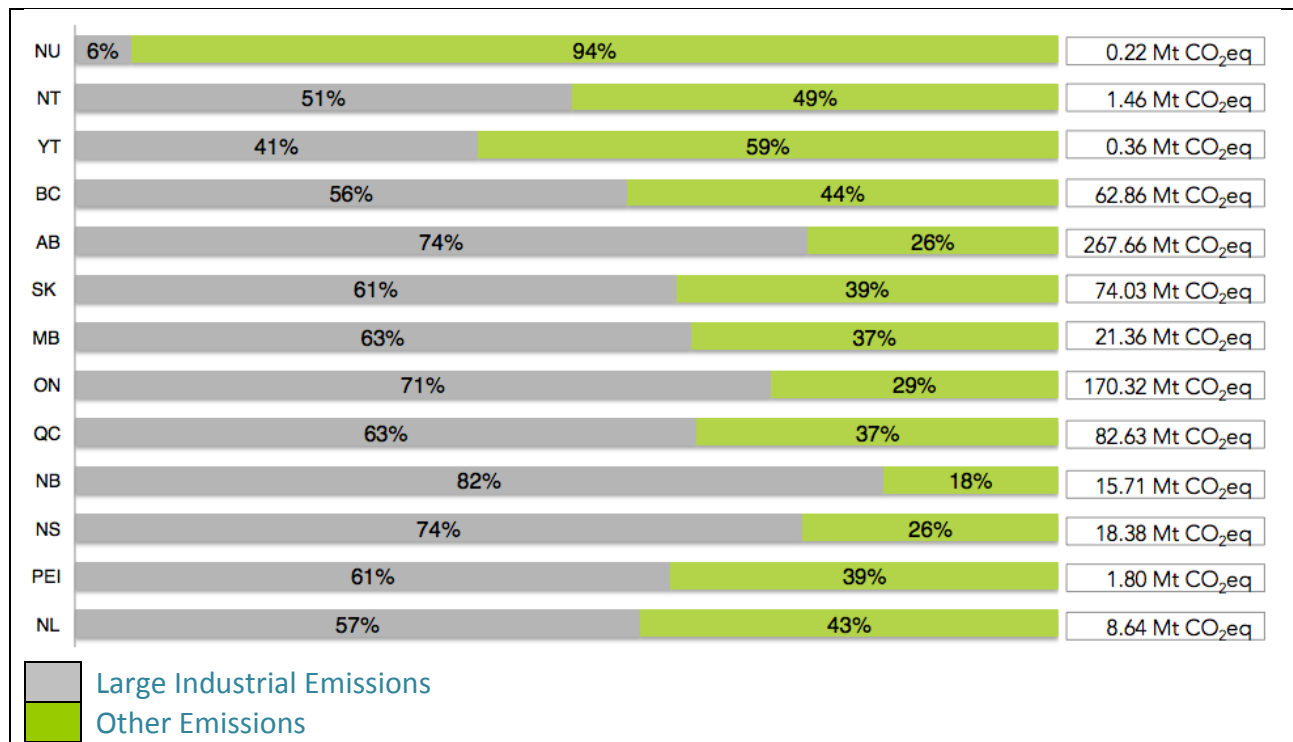
In 2013, the company transitioned into CMC Research Institutes, a not-for-profit that accelerates the development and scale-up to commercial use of technologies that reduce greenhouse gas emissions from industrial sources. We deliver effective emission reduction solutions to help combat one of the greatest challenges of our times – anthropogenic climate change.

CMC has now built an extensive national and international collaborative network of experts to support the innovation efforts of our clients. We are creating clusters of Canadian and global expertise, services and facilities to accelerate and deliver multi-sector innovation to eliminate industrial greenhouse gas emissions across a number of sectors.

Executive Summary

CMC Research Institutes is leading the transformation of Canada’s industrial economy to thrive in a low carbon world. Industrial emissions account – in every jurisdiction in the country – for a significant portion of Canada’s GHG challenge. The table below highlights the challenges for the country in meeting its GHG reduction targets, emphasizing that consistent and disciplined actions are required in the industrial sectors to reduce emissions over the coming years. An appropriate suite of applied solutions will need to be designed, tested and implemented in real-world situations, requiring the kind of applied research and development approach that CMC specializes in.

Figure 1: Canada’s Industrial GHG Emissions*



Source: Environment Canada 2015 NIR Report – 2013 data

Total: 724.5 Mt CO₂eq

* Industrial emissions include the following NIR sectors: Public electricity and heat productions, petroleum refining, mining, oil and gas production, manufacturing, mineral production, metal production, agriculture and waste.

Our unique approach encompasses the development of novel technologies for industrial emissions as well as the policy and economic landscapes that will allow for the scale-up of new solutions. We aim to streamline and simplify the path from the bench to commercialization so

that researchers and technology developers have greater success bringing their products and services to market.

CMC is organized into three institutes and also offers a comprehensive range of programs and services to help de-risk investment decisions and accelerate technology development. The three institutes are:

- Containment & Monitoring Institute (CaMI)
- Carbon Capture & Conversion Institute (CCCI)
- Low Carbon Pathways Group (LCPG)

We provide the services required to move concepts from lab bench to field by:

- Operating a field research station where national and international researchers collaborate on technology development and field testing, and a new generation of academic and industry researchers and professionals are trained.
- Constructing a Technology Commercialization and Innovation Centre to develop carbon capture and conversion technologies, readying them for scale up to field pilot or international competitions, such as the COSIA/NRG Carbon XPrize.
- Identifying and assessing commercially viable early stage technologies.
- Convening and managing consortia to facilitate field pilot programs.
- Providing techno-economic modeling of future scenarios for policy and regulatory impacts.

One of CMC's great strengths lies in its ties to researchers in numerous international organizations such as Ohio State University, the University of Arizona, the University of Queensland, Lawrence Berkeley National Laboratory, the Stanford Centre for Carbon Storage, SINTEF and NTNU in Norway, GFZ German Research Centre for Geoscience in Potsdam, the UK Carbon Capture and Storage Research Centre, the Korea CCS Research Centre, and the Cooperative Research Centre for Greenhouse Gas Technologies (CO2CRC) in Australia.

Our approach is novel. We pursue new pathways to reduce industrial greenhouse gas emissions to combat climate change and help Canada develop important ways to transition to a low carbon future.

1. *What federal measures would help **Canadians** generally – and such specific groups as the unemployed, Indigenous peoples, those with a disability and seniors – maximize, in the manner of their choosing, their contributions to the country’s economic growth?*

Investing in the talent that will deliver industry success is just one of the ways CMC is keeping its eye on the future. As the global economy moves into a carbon constrained era, we are going to require a skilled people capable of working in carbon management and clean energy.

In fact, a recent study commissioned by CMC shows just how many more positions Canadian industry will require. Our forecast shows that for Canada to achieve its long-term GHG emission reduction targets by 2050, the labor force will require as many as 27,000 additional, full-time equivalent positions in 2030. High demand areas will include engineers, geologists, geophysicists and hydrogeologists as well as construction trades, project managers and process operators.

At Carbon Management Canada, we supported 250 trainees collaborating on carbon management projects in disciplines including engineering, geosciences, geography, chemistry, nanotechnology, biology, law and business. The research projects funded by CMC were interdisciplinary and included both national and international universities. We also provided opportunities for training outside of the lab and the classroom so these highly qualified people are better prepared to step into professional positions in industry. Students were able to take advantage of summer schools, workshops, webinars and exchange programs.

As the company CMC Research Institutes, we continue to offer value-added experiences at our institutes where junior researchers gain critical experience by working to solve industry-identified challenges. We will also partner with select companies to offer junior researchers opportunities to make connections and learn about industry, and industry challenges, first-hand.

Recommendation: *Ensure that Canadian and international researchers and highly skilled talent can participate with CMC and other organizations like ours through both cooperative labour market policies with the provinces and streamlined processes for highly skilled personnel to enter Canada for project based work.*

2. What federal actions would assist **Canada's businesses** – in all regions and sectors – meet their expansion, innovation and prosperity goals, and thereby contribute to economic growth in the country?

In a growing global economy, the demand for energy from fossil fuels will continue to increase. At the same time, the transition to a low carbon future is inevitable. At CMC, we are working to find commercially viable ways to reduce greenhouse gas emissions that will be critical to the ongoing operations of many industries, including the fossil and renewable fuels, chemical, cement, mining and metallurgical processing industries.

Technology evaluation can help corporate and government decision-makers evaluate and invest in strategies that will improve industrial environmental performance in ways that make economic sense. One of the main reasons for not implementing carbon management procedures or technologies is a lack of information about the impacts of adoption. The goal is to develop the tools and methods to assess energy innovations to ensure economic growth is not sacrificed and unintended consequences are minimized.

The cement industry is a great example of a sector where we can do a lot to reduce carbon emissions through process efficiencies, CO₂ capture and conversion, and the use of renewable energy sources. The cement industry in Canada is responsible for up to 2% of the country's CO₂ emissions, much of it due to burning coal. While carbon emissions could be reduced through changes to the cement-making process and by introducing biomass and other low carbon fuels into the system, there is limited science to demonstrate the effectiveness of these changes. Queen's University Professor Warren Mabee and his team were funded initially through Carbon Management Canada to work with Lafarge and Natural Resources Canada on a multi-year project to test different bio and waste fuels at pilot plant facilities. This is the first science to include comparative life cycle assessments, full emissions comparisons, evaluation of water use and burner optimization and has been extended into additional waste fuel alternatives. The goal is to show that alternative fuels can safely and effectively displace coal in existing industrial processes.

Recommendation: *To achieve its clean growth and low carbon objectives, the federal government can provide certainty in policy, market-based mechanisms and regulation to support consistent, long-term industrial research. Clearer long-term frameworks and cooperative approaches with provinces will allow industry partners and governments to invest in the kind of incremental and breakthrough technology and applied research to deliver specific and tangible emissions reductions in the short, medium and long-term.*

3. *What federal measures would ensure that urban, rural and remote **communities throughout Canada** enable residents to make their desired contribution to the country's economic growth and businesses to expand, prosper and serve domestic and international customers in order to contribute to growth?*

A critical need in carbon management is to find better, cheaper ways to capture CO₂. This will contribute to long-term sustainability, especially of the resource sectors. Governments across Canada and around the world are challenged with developing solutions to decarbonize industrial emissions. The task is complex with multiple internal and external stakeholders, all with competing interests and needs.

CMC is uniquely positioned as a neutral not-for-profit working to bridge the research-to-practice technology gap. As a neutral organization of globally recognized scientific researchers we can convene working groups of world experts and facilitate stakeholder engagement processes such as workshops and other interactive exercises to identify prospective low carbon technical options.

An under-served section of the technology development spectrum is between early stage research and commercialization. There are few facilities available where researchers can scale-up, pilot and field test their work to demonstrate success at large scale. CMC bridges this gap through its pilot and field-test facilities - each aimed at developing technology solutions for different greenhouse gas management challenges. We are filling a global void. For example, our field research station in Alberta is attracting academic, industry and government researchers from around the world who are sharing equipment and collaborating on research projects in ways previously unimagined - leading to safer, more secure underground storage of carbon.

Recommendation: *By supporting accelerators and applied research like our projects, the government can ensure that solutions can be devised, tested, implemented and ultimately exported to countries seeking to lower carbon emissions. By demonstrating Canada's leadership across research, commercialization and access to foreign markets, the federal government can support domestic innovators and contribute to economic growth. With the First Ministers set to agree on a Framework for Clean Growth and Climate Change this fall and expected investments in GHG reductions in Budget 2017, the federal government is already on track to support a low carbon trajectory. CMC's domestic and international work is an important contributor and we look forward to helping the government shape the kind of applied solutions that integrated models like CMC offer.*

The federal government is in a position to examine a range of fiscal, policy and program tools to support scale-up and commercialization of these technologies, including accelerated

capital cost allowance, access to offset credits in carbon pricing formulas, tools to mitigate early mover risk and opportunities to qualify for green investment funds, or potentially through the Low Carbon Trust once it is established. There are a range of signals that federal and provincial governments can send to incent behaviours and investments that are consistent with its stated policy goals on climate change.

Conclusion

Transitioning to a low-carbon economy will require ingenuity, innovation and dedicated field work to reduce industrial emissions, a significant contributor to Canada's GHG challenge. CMC Research Institutes design, create and operate clusters which catalyze and deliver multi-sector technology innovation to eliminate industrial GHG emissions and has a track record of success, early applications and internationally recognized expertise and networks. We trust that in Budget 2017, the government of Canada will continue to devise tax, policy and program tools to support its ambition for a clean growth economy. CMC stands poised to help.