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CLIMATE CHANGE AND EXTREME WEATHER EVENTS

THE ENGINEERING PROFESSION'S POSITION:

- There is overwhelming scientific evidence that the world's climate is changing and there is a strong urgency to adapt to this change while still encouraging mitigation efforts to slow the rate and magnitude of climate change.
- In serving the public interest, engineers are uniquely qualified and positioned to ensure that Canada's infrastructure is designed and maintained to resist and recover from the impacts of extreme weather and long-term changes to our climate.
- Bodies responsible for engineering codes, standards, and work practices must consider climate change when reviewing, establishing, or updating codes, standards, and work practices. Improved climate science understanding and modelling future projections is crucial to reducing uncertainties associated with future scenarios.
- It is imperative that federal and provincial governments consult and collaborate with the engineering profession on policies relating to climate change and extreme weather events for the benefit of the public that they both serve.
- Education and professional development must provide engineers with the required information, skills, and techniques to properly design and adapt to the future challenges posed by climate change.

The challenge(s)

Extreme weather and rapid changes to Canada's climate present a profound risk to both public safety and the reliability of Canada's infrastructure. The disruption and cost to Canada's economy when infrastructure is damaged or destroyed by extreme weather events is growing and becoming more frequent across Canada. Much of Canada's existing infrastructure is vulnerable. In 2018, insured damage for extreme weather events in Canada reached $1.9 billion.[1] In mid-April of 2018, an ice storm that affected southern Ontario had resulted in more than $190 million in insured damage.[2] In December of the same year, storms in British Columbia caused $37 million in insured damage.[3]

Considering the limited funding to address massive infrastructure needs, it is more important than ever for engineers, proponents, and policy makers to understand the full economic and environmental costs of infrastructure project decisions—and not just impacts relating to material choice or from initial construction, but the impacts of choices across the entire life cycle of a project.

Infrastructure owners need the capacity and knowledge to assess the climate vulnerability of new and existing infrastructure to plan and manage potential extreme weather impacts. Such analysis not only helps identify issues and solutions in order to adapt the infrastructure to the impact of climate change, but also provides evidence to improve existing policies and procedures as well as develop new ones to address emerging needs, issues, and concerns.

How Engineers Canada has contributed

Engineering is on the front line in the provision of infrastructure to society. For this reason, engineers have a significant role to play in addressing climate change issues and incorporating them into engineering practice in Canada.

Since 2005, Engineers Canada has partnered with the provincial and territorial engineering regulators and other organizations to engage engineers with scientists, policy planners, industry leaders, and government decision-makers to discuss how to adapt public infrastructure to climate change.

Between August 2005 and June 2012, Engineers Canada, with funding from Natural Resources Canada and in collaboration with partners from all levels of government and other sectors, formed the Public Infrastructure Engineering Vulnerability Committee (PIEVC). The committee developed and validated the PIEVC Protocol, a tool to be used for vulnerability assessments of infrastructure systems located in small communities and large urban centres, in Canada's North and most recently in First Nations communities. The experiences and outcomes from these assessments have enabled the profession to engage with stakeholders on climate-related infrastructure policy and procurement. Engineers Canada was also an active contributor to the federal government's Pan-Canadian Framework on Clean Growth and Climate Change published in the fall of 2016, which aims to meet the country's targets to reduce emissions, transition to a low-carbon economy, and build resilience to a changing climate.

In June 2018, the Government of Canada announced that as part of the Investing in Canada Plan, new major infrastructure projects that are seeking federal funding will be required to undertake an assessment of how their projects will contribute to or reduce carbon pollution, and to consider climate change risks in the location, design, and planned operation of an infrastructure project. Infrastructure Canada requires that a professional engineer, registered professional planner, or appropriately specialized biologist or hydrologist provide an attestation that the climate change resilience assessment was carried out using a methodology that is in accordance with ISO 31000 Risk Management standard. The Climate Lens also lists the Engineers Canada-founded PIEVC Protocol as one

of these methodologies for climate change resilience that is consistent with ISO 31000.

In 2018 Engineers Canada published a national practice guideline on the Principles of Climate Change Adaptation and Mitigation for Professional Engineers[4] that provides guiding principles for engineers to consider climate change in their professional practice.

Recommendations for the federal government

Engineers and the engineering community have the necessary knowledge that is imperative to dealing with the issue of climate change and extreme weather events. The profession has been engaged in this issue for over 15 years with a focus on infrastructure climate vulnerability and risk assessment, as well as proposing adaptation policies, strategies, and professional practices to improve resilience.

It is Engineers Canada's view that climate resiliency across the entire lifetime of infrastructure is the goal, and adaptation is the key strategy to achieve it. Therefore, all adaptation actions should lead to an outcome of improved resiliency for all communities be it municipalities, cities, towns, or reserves.

Engineers Canada encourages the federal government to continue to require climate vulnerability processes and risk assessments to be a condition for funding approvals of infrastructure projects. This policy should be applied across other federal departments who own and operate existing infrastructure or design and construct new infrastructure. We are encouraged to see that Transport Canada and Public Works and Procurement Services are conducting assessments as part of their long-term asset management planning. We encourage other federal departments owning infrastructure to do the same.

Climate risk assessment should be incorporated as part of the policy framework for environmental impact assessment of infrastructure projects. Similarly, as policy required for approval of designs for infrastructure projects involving rehabilitation, re-purposing of all existing infrastructure, as well as new construction.

The federal government will benefit greatly on this significant public policy issue through a range of efforts that include:

- Consultation and collaboration with the engineering profession on policies relating to climate change. The profession can provide independent, unbiased, and credible expertise and advice on climate adaptation and mitigation that governments can consider to develop sound evidence-based policies.
- Continuing to fund climate research to assess impacts and adaptation, and inform the development and updating of codes, standards, and other instruments thereby increasing the confidence of climate design data used by engineers.
- Promoting awareness of climate change impacts, adaptation measures, and GHG reductions with communities and industry. This includes working with provincial and territorial governments to understand, assess, and adapt to changes in Canada's climate, including the unique challenges in Canada's North.
- Promoting information-sharing between engineers, scientists, and other key stakeholders regarding current best adaptive practices and regional climate data sets.
- Maintaining and improving a national network of climate and watershed data collection systems, including partnerships with other levels of government in accordance with national standards and quality control measures. This includes supporting established regional hubs including OURANOS and the Pacific Climate Impacts Consortium that provide more localized products and services as well as newer developing hubs such as the Prairie Adaptation Research Collaborative at the University of Regina.
- Continuing efforts to improve the accuracy and resolution of climate change projection models and support provincial efforts to develop up-to-date, reliable regional climate data sets and trend analyses. This includes supporting demonstration projects and validating best practices to become standard practices.
- Continuing to support the Natural Resources Canada Climate Adaptation Platform, which continues to provide an excellent forum for collaboration, communication, and capacity-building between all stakeholders.
- Continuing to support the Canada Centre for Climate Services (CCCS) in its provision of climate data, information products, and advisory services to Canadians. Engineers require scientifically defensible climate information and future projections that are supported by the legal authority of the federal government through CCCS.

How Engineers Canada will contribute

Engineers must adapt their professional practice to consider the impacts of extreme weather and Canada's changing climate. As professionals develop strategies to reach public safety, reliability, sustainability, and resilience goals, it is vital that engineers adopt methodologies that use a life-cycle perspective to evaluate impacts and use that knowledge to generate strategic paths moving forward. They should acquire the requisite knowledge, skills, and experience, and consult with other professionals including climate specialists to properly address this issue in each project.

Engineers Canada can advise the federal government on the research, information, and funding needed to safeguard infrastructure and communities that are vulnerable to the effects of climate change.

Engineers Canada will continue to actively:

- Work with engineering regulators to raise awareness on the needs and methods to consider extreme weather and longer-term climate change in engineering decisions. This includes developing guidance to embed climate adaptation and mitigation principles in professional practice and through our regulators, an engineers' standard of practice.
- Continue to take a leadership role in assuring that codes, standards, and practices embody principles that promote a low carbon, clean environment and a sustainable economy through low carbon, climate resilient infrastructure and the services it provides.
- Provide advice and leadership to our regulators by developing and maintaining national practice guidelines, such as the National Guideline for Principles of Climate Change Adaptation and Mitigation for Professional Engineers. This effort includes the delivery of professional development to engineers in partnership with our regulators on national guidelines, as well as promoting tools such as the PIEVC Protocol and information needed for engineers to adapt their designs, improve operations and maintenance of public infrastructure, and improve measures to mitigate emissions that contribute to climate change.

[1] Insurance Bureau of Canada. (2017). "Severe Weather Causes $1.9 billion in Insured Damage in 2018." Retrieved June 11, 2019 from: http://www.ibc.ca/on/resources/media-centre/media-releases/severe-weather-causes-190-million-in-insured-damage-in-2018.

[2] Ibid.

[3] Ibid.

[4] Engineers Canada (2018). "Principles of Climate Change Adaptation and Mitigation for Professional Engineers." Retrieved August 13, 2019 from: https://engineerscanada.ca/publications/public-guideline-principles-of-climate-change-adaptation-for-professional-engineers.

[5] The Council of Canadian Academies (2019). "Canada's Top Climate Change Risks: The Expert Panel on Climate Change Risks and Adaptation Potential." Retrieved August 12, 2019 from: www.cca-report.ca.