CSA GROUP™

WORKSHOP REPORT

Low Carbon Climate Resilient HCF Design

February 2024

Canada's health care infrastructure faces challenges, relating to aging facilities, availability of capital investment, increased demand for services, and the need to adopt digital and innovative technologies.

Background

Canada's health care infrastructure faces challenges, relating to aging facilities, availability of capital investment, increased demand for services, and the need to adopt digital and innovative technologies. These challenges are exacerbated by the impacts of climate change on the existing healthcare facilities. . As they are expected to provide continuous service to the population including during and after extreme weather events, ensuring the infrastructure is climate-resilient will be essential to the well-being of Canadian communities.

Furthermore, research reveals that the healthcare system is responsible for approximately 4.6% of Canada's GHG emissions.[1] To address these emissions, it is essential to integrate health care and climate change policies and actions in a holistic and coherent manner. This would not only benefit the environment and human health, but also contribute to the achievement of Sustainable Development Goals, and help Canada achieve its 2030 and 2050 emission reduction targets.

The 2021 budget unveiled financial support for Standards Council of Canada's (SCC) Standards to Support Resilience in Infrastructure Program (SSRIP). This enabled the SCC to continue working with Canada's national standardization network, fostering the creation and implementation of standardized solutions. These efforts aim to enhance infrastructure resilience and sustainability, ultimately contributing to stronger Canadian communities.

The overall objective of the SSRIP is to advance standardization strategies that help Canadian households, businesses, and communities adapt to the impacts of climate change. This supports the vision of establishing a climate-resilient and sustainable built environment in Canada, with a particular emphasis on health infrastructure. The next edition of CSA Z8000, *Canadian Health Care Facilities*, is underway and SCC is funding and working with CSA Group to support the integration of climate change considerations into the standard.

1 CMAJ 2019 December 2;191:E1342-3. doi: 10.1503/cmaj.1095834

CSA Z8000 and the role of standards in the health care system

Standards are an important part of the quality framework supporting health care delivery. By outlining requirements and best practices standards can help patients, staff, and visitors avoid injury from medical devices and assist in reducing the incidence of health care-associated infections. Through their evidence-informed design and practices, standards can also help build health care facilities that last longer, operate more efficiently, and better serve their users.

CSA Z8000 provides requirements and guidance for the planning, design, and construction of Canadian HCFs. It is intended to be used by facilities providing health care services regardless of type, size, location, or range of services. Many concepts set out in the Standard, such as isolating patients with infections and single-patient rooms, were informed by research that commenced after the SARS crisis of the early 2000s and challenged the accepted design practices at the time. Subsequent Standard updates happened in a similar way – through learned experience, reflecting changes in the health care system.

The next edition of CSA Z8000 is anticipated to publish in December 2024. For this new edition, the Technical Subcommittee is considering various updates to address challenges HCFs faced during the Covid-19 pandemic, climate change considerations, design requirements for HCFs in small and remote communities, and many other topics.

Understanding low carbon climate resilient HCF design:

To incorporate climate change considerations in the new edition of CSA Z8000, CSA Group formed a new Working Group (WG) to facilitate and support this initiative, and conducted a series of workshops to gain a deeper understanding of the matter. The WG contained national representation, consisting of the following members:

Cathy Mcdonald, Provincial Health Services Authority

Alice Dixon, Infrastructure Ontario

Katelyn Poyntz, Unity Health Toronto

Craig Dedels, Vancouver Coastal Health

Nick Stark, H.H. Angus & Associates Limited Consulting Engineers

Fiona Miller, University of Toronto

Steve Rees, Alberta Health Services

Beverly Cousins, Government of Nunavut

Theo Potgieter, Government of Nunavut

William Glenn, Government of Nunavut

Kathryn Wyndham, Provincial Health Services Authority

Cliff Harvey, Niagara Health

On March 3, 2023, and March 22, 2023, CSA Group hosted a two-part workshop to gather input from experts across Canada to explore how CSA Z8000 can support low carbon climate resilient HCF design. Part 1 consisted of a series of presentations and panel discussions on environmental sustainability topics including, climate resilience planning, embodied

HFC climate resilience planning

carbon, and the integration of climate change requirements into the HCF planning process. Part 2 consisted of breakout room sessions to further investigate and brainstorm how to design low carbon climate resilient HCFs. All feedback from the workshops will be considered in the development of the new edition of CSA Z8000.

During the workshop, several key themes emerged to guide the integration of climate change considerations into the new edition of CSA Z8000. Firstly, the importance of incorporating climate resilience planning, including climate hazard exposure screening, climate risk assessments, and resilient design review, as early as possible in the planning and design process of HCFs was highlighted. Similarly, participants stressed the early incorporation of energy management and sustainability planning. Another crucial aspect identified was the need for clear direction regarding cost targets, measurable outcomes, accountability processes, and integrated design.

The workshop highlighted the significance of informing HCF designs on future climate parameters, such as heating degree days (HDD) and cooling degree days (CDD). Additionally, it was emphasized that embodied emissions should be taken into consideration during the design process. The importance of integrating disaster recovery and business continuity planning alongside low carbon climate resilient HCF planning, and design were also highlighted.

Furthermore, the workshop suggested a preference for the renovation of existing spaces over demolition whenever possible. Additionally, participants noted that where feasible, older equipment should be replaced with high-efficiency equipment or technology. These themes provide valuable insights for shaping the upcoming edition of CSA Z8000 to effectively address climate change considerations in the planning and design of HCFs.

What We Heard – Breakout Room Discussions:

During the second workshop, participants were presented with a series of questions to facilitate meaningful discussion. Following the sessions, organizers identified and compiled the overarching themes that were received in response to each question.

What are best practices when conducting climate risk assessments and applying the results to develop resilient facilities?

In the context of HCFs planning and design, the criticality of starting climate risk assessments as early as possible in the design process was noted.

To facilitate this, it was recommended that a checklist or assessment tool be developed, and that this checklist be distinct from an infrastructure assessment tool. The iterative development of the risk assessment matrix was also acknowledged as an essential component of facility design.

Best practices were emphasized, including the identification and incorporation of relevant guiding documents, such as Infrastructure Canada's Climate Lens, ISO 14091, and Public Infrastructure Engineering Vulnerability Committee (PIEVC) Protocol. They also included the definition of a risk assessment methodology, and formation of risk assessment teams, including HCFs operators, clinical and facility managers, among other stakeholders as well as consideration and incorporation of business continuity, emergency preparedness, post-disaster recovery, and nature-based solutions.

For a thorough climate risk assessment, the importance of envisioning the impact of adverse events was highlighted, with secondary or cascading impacts, which are often overlooked, being recognized as key components of the evaluation. Common results of adverse events, including loss of water and/or sewage, health workforce impacts, and changes to supply chain reliability, underscore the complexities inherent in an assessment of this nature.

Moreover, the integration of HCF climate risk assessments with regional climate risk assessments for each level of government was stressed, in order to allow for a holistic understanding of the vulnerabilities.

What are the key elements of the HCF planning and design process to develop low carbon climate resilient HCF? How do we balance the climate adaptation strategies vs climate mitigation strategies for HCF design?

Similar to the approach taken with climate risk assessments, workshop participants emphasized the importance of incorporating concepts for a low carbon climate resilient HCF as early as possible in the planning and design process. The need to establish performance-based metrics around energy intensity, the carbon cost

of operating HCF, and other benchmarks at project initiation, with a recommendation for clearly defined minimums was highlighted.

In the planning and design process, it was noted that consideration should be given to using forward looking climate models aligning with the lifecycles of equipment and solutions utilized to address climate resiliency. HCF systems should be designed to incorporate scalability, so that they can adapt to meet projected demands based on the future climate models and anticipated loads.

The reduction of water and energy consumption for HCFs was articulated as a general goal for the planning and design process. To meet this goal, strategies including, but are not limited to, passive heating and cooling, heat recovery systems, and ground source heat exchangers were highlighted.

Recognizing that the outcomes of climate adaptation strategies and climate mitigation strategies are often synergistic, participants advocated for pursuing strategies that achieve synergies. For example, lowering HCF energy consumption not only aligns with climate mitigation initiatives, but also makes it easier to provide backup power.

It was acknowledged that balancing cost, the post-disaster role of a HCF, climate adaptation, and climate mitigation strategies is a challenge which may require compromise during the planning and design process. Additionally, considerations regarding the lifecycle of facility components can also impact planning adaptation measures and the cost-benefit for capital expenditures. Selecting low carbon climate resilience for long-lived elements like the building structure, envelope, and clinical systems, over shorter-lived components that will be renewed during asset lifecycle facilitates the development of a HCF with sustained low carbon emissions. Documentation of the co-benefits of these measures in design requirements for consultants enhances the project's overall understanding and supports the business case for capital expenditures. This approach can help ensure a resilient and environmentally conscious HCF.

What are commonly used climate risk mitigation/ adaptation strategies and how transferable are they between HCFs? Please consider new and existing facilities.

Several climate risk mitigation and adaptation strategies were identified as being transferable across various settings including HCF. Examples included, but were not limited to:

- heat recovery,
- heat pumps (ground/water/air sourced),
- passive heating and cooling strategies,
- stormwater detention/retention/reuse,
- integration of onsite renewables (e.g., microgrids),
- thermal storage,
- fan convectors for low temperature distribution of heat,
- control systems that minimize waste (demand control, variable speed, submetering of electrical heating and cooling loads),
- fault detection systems,
- contingency planning (extreme weather, supply shortages),
- training and capacity building, and
- alarm and alert management systems.

Distinct to HCFs, processes such as humification and sterilization are energy-intensive and have a high

reliance on natural gas. Addressing these unique processes requires careful consideration of the risk of stranded assets due to carbon pricing and regulation, and participants highlighted the need to explore alternative methods to achieve these processes in a more sustainable manner.

From a planning perspective, it was identified that HCFs should consider the impact of rising temperatures, including greater air flow, variations in cooling loops, and adjustments to the building envelope. When planning defining criteria, such as heat degree days, wet bulb temperature for summer and winter, and establishing reference guidelines become essential.

In anticipating extreme heat scenarios and potential ambulance influxes into HCFs, provisions for cooling centers should be incorporated into the facility design in parallel with surge planning. Additionally, building infrastructure should be designed with increased redundancy to accommodate projected rises in cooling loads throughout the life of the HCF.

When retrofitting or undergoing a renovation, it was recommended that heat recovery options, such as from sanitary exhaust, be explored. Additionally, opportunities for improved efficiency through enhanced operational processes should be considered.

Given the dynamic nature of climate change, further climate risk assessments may be required. Continuous evaluation and adaptation to evolving conditions can help ensure that HCFs remain resilient and responsive to the challenges posed by climate change.

Additional resources:

Within the workshop and its associated breakout rooms, multiple resources were identified as instrumental in the planning and design of HCFs. Though the following list is not exhaustive, it can serve as a starting point for practitioners in the field.

List of Resources	Description
Canada's National Adaptation Strategy: Building Resilient Communities and a Strong Economy	Canada's first National Adaptation Strategy lists near-term targets, medium-term objectives, and long-term goals. It provides a comprehensive National Strategy to aid in mobilizing resources, identifying gaps, and tailoring the most effective local solutions.
Climate change and health vulnerability and adaptation assessments: A knowledge to action resource guide	This resource guide presents tools and information that can help inform the development of rigorous and participatory Climate change and health vulnerability and adaptation assessments (V&As) from local to national levels in Canada.
Climate Data for a Resilient Canada	This climate data portal was produced collaboratively by the country's leading climate organizations and supported, in part, by the Government of Canada. The goal of this portal is to support decision makers across a broad spectrum of sectors and locations by providing the most up to date climate data in easy-to-use formats and visualizations.
Climate Resilience Guidelines for BC Health Facility Planning & Design	The Climate Resilience Guidelines for B.C. Health Facility Planning and Design (v1.1) is a living document that is intended to both capture current best practices for immediate application and enable continuous improvements through an iterative and collaborative process.
Environment and Climate Change Canada: Climate-resilient buildings and core public infrastructure 2020: an assessment of the impact of climate change on climatic design data in Canada	The report provides an assessment of how climatic design data relevant to the National Building Code of Canada (NBCC 2015, Table C-2) and the Canadian Highway Bridge Design Code (CHBDC/CSA S6 2014, Annex A3.1) might change as the climate continues to warm.
Environmental Stewardship: An Implementation Guide For Boards, Executive Leaders, And Clinical Staff: Meeting Hospital Standards And Beyond	This guidebook provides an overview of some of the key steps and actions that senior leaders can initiate and support for their hospital to move towards a climate-resilient, carbon net-zero, and environmentally sustainable health system.
Green Health Care: Green Hospital Scorecard	The Green Hospital Scorecard (GHS) is a comprehensive health care environmental performance benchmarking tool in Canada measuring energy conservation, water conservation, waste management and recycling, corporate commitment and pollution prevention.
Health Care Facility Climate Change Resiliency Assessment checklist	The Canadian Coalition for Green Health Care with support from the Nova Scotia Department of Environment has co-developed the Health Care Facility Climate Change Resiliency Toolkit, which health care facilities can use to assess their resiliency to climate change. The checklist includes questions in many areas, such as: emergency management, facilities management, health care services and supply chain management. Completion of the assessment checklists by officials with knowledge and experience in these areas, can increase awareness and inform resiliency activities.

List of Resources	Description
Health of Canadians in a Changing Climate	This report provides an assessment of the risks of climate change to the health of Canadians, to the health care system, and provides adaptation options. Led by Health Canada, the report was released in 2022.
Infrastructure Ontario Climate resilience program Description Case Study	These resources describe Infrastructure Ontario's program to integrate climate considerations into infrastructure development and property management processes.
Integrated Design Guide	This document is intended as a standard guideline to support the building industry in the practice of integrative design. The purpose of Integrative Design is to effectively manage the optimization of complex systems while pursuing sustainable practices in design and construction.
International Performance Measurement and Verification Protocol (IPMVP) Standard	The purpose of the IPMVP is to reduce barriers to the energy and water efficiency industries.
ISO 50001: Energy Management	Designed to support organizations in all sectors, this ISO standard provides a practical way to improve energy use, through the development of an energy management system (EnMS).
Low carbon resilience and environmental sustainability (LCRES) Guidelines	The purpose of the Low Carbon, Resilience and Environmental Sustainability Guidelines for Health Care New Construction (LCRES Guidelines) is to enable implementation of low-carbon, climate-resilient and environmentally sustainable strategies as part of new construction and major renovations of acute, long-term care and other healthcare facilities.
Low carbon resilience Tool	The LCR Co-Benefits Tool is designed to illustrate and inspire systemic thinking through showcasing the multiple benefits of taking integrated climate action. This tool is designed to be used by local government staff to advance climate action in lockstep with other social, economic, and environmental goals.
Low-hanging fruit PEACH tree	The peach tree diagram compares the impact of interventions on costs and GHG emissions across seven different categories.
National Research Council of Canada: Design Value Explorer	The Design Value Explorer is a new web-based, technical tool for accessing 19 climatic design values based on observed data and projections of how they may change in the future. This advisory tool allows professionals to examine how climate change will influence designs under different potential future scenarios.
NRCan "National guidelines for Whole Building life cycle assessment"	This document provides comprehensive instruction for the practice of life cycle assessment applied to buildings, based on relevant standards and keyed to various intentions.
Regeneration Podcast titled "The Seven First Principles of Regeneration with Carol Sanford"	This is a podcast that discusses Carol Sandford's living systems framework called *The Seven First Principles of Regeneration*.

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SCC Climate Change Guide	This Guide is meant to educate and support standards writers to incorporate climate change adaptation considerations into National Standards of Canada that are under development or revision. It introduces principles, methods and techniques and provides examples to facilitate its use, through case studies.
Sustainable Food	Nourish accompanies health care institutions to shift their menus and purchasing to food that is better for both people and the planet, providing them with tools for innovation and action.
U.S. Climate Resilience Toolkit – Sustainable and Climate-Resilient Health Care Facilities Toolkit	The Sustainable and Climate-Resilient Health Care Facilities Toolkit provides an overview guide and a suite of online tools and resources highlighting emerging best practices for developing sustainable and climate-resilient health care facilities.
WHO - Climate-resilient and environmentally sustainable health care facilities	This guidance aims to assist countries in identifying and implementing interventions that provide resilience from external climate-related shocks, and that protect the health workforce and their serving communities from environmental threats.
WHO guidance for climate resilient and environmentally sustainable health care facilities	The aim of this guidance is to enhance the capacity of health care facilities to protect and improve the health of their target communities in an unstable and changing climate; and to empower health care facilities to be environmentally sustainable, by optimizing the use of resources and minimizing the release of waste into the environment.
WHO Operational framework for building climate resilient health systems	This document presents the World Health Organization (WHO) Operational framework for building climate resilient health systems.

Next Steps:

The Technical Subcommittee responsible for the development of the content for CSA Z8000, along with its Working Groups, reviewed the comments and themes identified during the Workshops in order to develop proposals for change for the new edition of the standard. This information will facilitate the incorporation of principles of low carbon climate resilient HCF design into the next edition of Z8000. This standard development is currently undergoing, and the new edition of CSA Z8000 is expected to publish in December 2024.

For more information about Z8000 and CSA's standards for Health Care Facilities in Canada, please visit https://www.csagroup.org/standards/areas-of-focus/healthcare-and-well-being/standards-for-safer-health-care-facilities-in-canada/.

CSA Group

CSA Group is a global organization dedicated to safety, social good and sustainability. We are a leader in Standards Development and in Testing, Inspection and Certification around the world including Canada, the U.S., Europe and Asia.

The mission of CSA Group's Standard Development organization is to enhance the lives of Canadians through the advancement of standards in the public and private sectors. As such, CSA Group continues to be at the forefront of standards research, development, education, and advocacy.

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