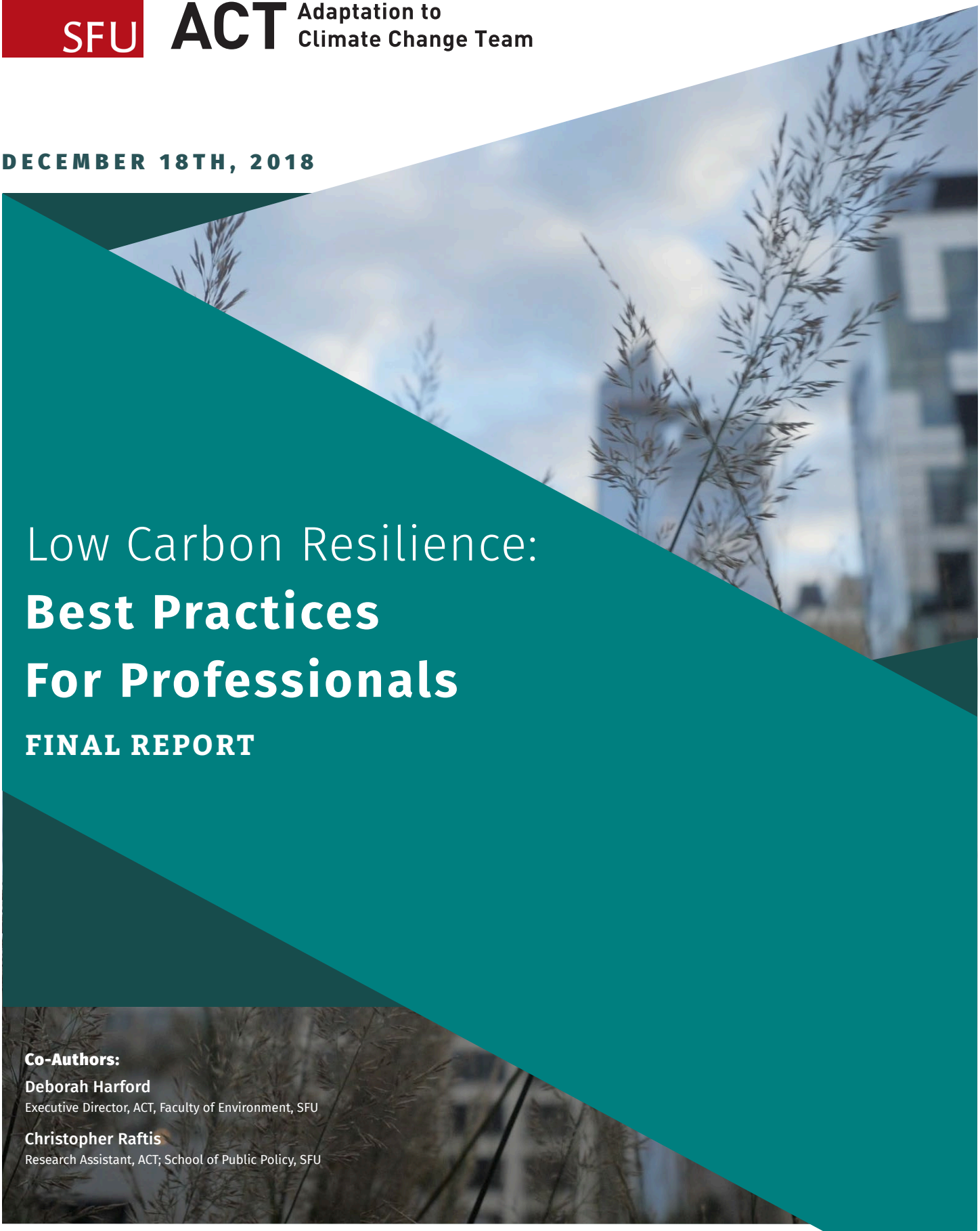
SFU ACT Adaptation to Climate Change Team

DECEMBER 18TH, 2018



Low Carbon Resilience:
Best Practices For Professionals

FINAL REPORT

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ACKNOWLEDGMENTS

ACT would like to thank the following team of expert advisers and reviewers, who provided invaluable insights, resources, writing, and research direction for this project and report:

Christine Callihoo, Senior Community Resiliency Planner, Independent Practitioner

Erica Crawford, Principal, Shift Collaborative (presenter, meetings facilitator and lead on development of joint statement for national professional associations)

Tamsin Mills, Board Member, ACT; Senior Adaptation Specialist, Independent Practitioner

Alison Shaw, Board Member, ACT; Principal, Flipside Sustainability

Steve Winkelman, Founder, Green Resilience Strategies (author of LCR diagram and considerations)

We deeply appreciate the contributions of the following graduate research assistants to this project:

Miriam Moore, Research Assistant, ACT; School of Public Policy, SFU (notetaker, ACTPAC meeting #2)

Jack Satzewich, Research Assistant, ACT; School of Resource & Environmental Management, SFU (contributing author: LCR Briefing Note, OCPs/CCPs case study)

Ronja Sorensen, Research Assistant, ACT; Aalborg University, Denmark (contributing author: City of Hamburg case study; notetaker, ACTPAC meeting #2)

ACT would also like to acknowledge the contribution of senior policy adviser and former BC Deputy Minister of Sustainable Resource Management, **Jon O'Riordan**, for his work on the LCR Briefing Note.

Many thanks to the **Fraser Basin Council** and the **Federation of Canadian Municipalities** for their collaboration in co-hosting and organizing the provincial and national professional association meetings, respectively.

ACT gratefully acknowledges the support of the **Vancouver Foundation** and the **Real Estate Foundation of BC** for this project overall, and the **Pacific Institute for Climate Solutions (PICS)** for the survey on continuing professional development and development of the LCR briefing note.

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EXECUTIVE SUMMARY

Progress on climate action in Canada is currently uneven across levels of government and professional sectors. Where greenhouse gas (GHG) emissions reduction (referred to in this report as "mitigation") and resilience building for current and future climate change impacts ("adaptation") are underway, they are largely being addressed separately.

As the 2018 IPCC Special Report makes clear, the need to advance mitigation and adaptation is now more urgent than ever before; moreover, integrating the two streams of action in research and practice via what we call "low carbon resilience" (LCR) policy, planning, and development approaches is potentially more efficient and effective than the current, largely siloed approach.

Climate changes such as intense heat and increased flood, and some of the potential adaptation responses to them, can significantly reduce the effectiveness of emissions reduction planning if not taken into account. Likewise, clean energy, renewables infrastructure, and land/water use planning designed to reduce emissions all have potential to contribute to or hinder the success of adaptation actions. Ensuring both climate action approaches are supported is important; integrating them through LCR approaches can reduce administrative and financial burdens and improve effectiveness, yielding multiple co-benefits, expanding access to funding and finance sources, increasing return on investment in adaptation, mitigation and infrastructure, and accelerating implementation of both mitigation and adaptation. In short, applying LCR as a lens on all planning and decision-making for all orders of government, professions, the private sector, and civil society organizations has the potential to increase opportunities to achieve transformative, systemic change.

This project focused on the key role professionals play as change agents in climate action, and what is needed for all sectors to advance uptake of LCR-based practices. Communities and businesses rely on professional planners, engineers, developers, lawyers, and other experts for guidance, design, development, implementation, operations, maintenance and replacement of all aspects of society's systems. Professionals are seminal in supporting and supplementing capacity at the local scale, where climate change impacts are felt most prominently, and where the greatest burden of response typically resides. It is therefore urgent that professionals are equipped to help local governments think through cost-effective plans that transcend outdated planning

modes by integrating an LCR lens; many professionals are well placed to do this as staff or service providers.

Climate change will exacerbate existing challenges and create new, unprecedented problems. Historical standards are no longer adequate to inform future planning. Climate change poses significant risks to all professional reliance models, which increasingly need to include climate change as part of advisory and consulting services. It is therefore crucial to develop a range of responses from training to new standards while mainstreaming integrated climate action into all planning and decision-making; however, there is as yet little action to advance the LCR approach in professional practice.

Responding to the challenge of climate change requires interdisciplinary insights and experience; however, early adopters and progressive practitioners have few forums within which to share knowledge collaboratively. It is therefore important that we begin to equip professionals with understanding of LCR approaches, create opportunities to build expertise on LCR, increase communication on the concept and practical approaches within specializations, and identify synergies across professions for collaborative solutions-building and transformative planning approaches.

The project team worked to collaborate with professionals across sectors to advance awareness of LCR and identify practical applications at a variety of scales. The case studies, tools and resources presented in this report were developed in consultation with professional representatives across Canada through meetings held in early spring and late fall of 2018 – at the local level in BC, with SFU ACT's Professional Advisory Council (ACTPAC), made up of senior practitioners; at the provincial level, with the BC Professional Associations Adaptation Working Group (PAAWG), hosted by the Fraser Basin Council; and with a diversity of national professional associations co-hosted in Ottawa with the Federation of Canadian Municipalities. Membership of these groups spans a range of professions engaged in climate change adaptation and mitigation practice, including engineering, law, agriculture, energy and utilities, forestry, flood management, accounting, water & wastewater management, real estate, development, policy, planning, health, insurance, architecture, and biology.

The first set of meetings identified key LCR needs and interest areas and formed the basis for development of the deliverables in this report. Results were presented at a second series of meetings in late fall that were designed to elicit feedback and provide insights on next steps. Resources requested by the professional groups and presented here include: 1) a briefing note on LCR, 2) a conceptual model and diagram plus considerations illustrating aspects of the core LCR approach, 3) examples of how LCR might be mainstreamed into tools in common usage by professionals (Official Community Plans (OCPs)/

Comprehensive Community Plans (CCPs) and the BC Energy Step Code), 4) case study examples of LCR in practice (a municipal action plan, a green infrastructure project, and a building design), 5) insights into needs and possibilities for training and continuing professional development (CPD), and 6) the foundation for a database or hub through which professionals can access key LCR-related tools and resources.

The professional groups also expressed the need for cross-sectoral collaboration and support. The BC PAAWG offers an excellent example of such collaboration in action. Members of the project team developed a joint statement for the national professional associations, modeled on one previously developed by the PAAWG, expressing intent to collaborate on advancing LCR. Several professional associations have signed this statement and will be developing LCR resources and tools for their members in 2019. All groups expressed interest in continuing the dialogue on LCR; ACT will continue to help facilitate discussion on this while advocating for leadership and ownership by professional associations on how LCR can be advanced within their areas of expertise. ACT will also continue to work to build LCR content for CPD purposes, policy analysis on LCR implementation and jurisdictional harmonization, and further case studies, cost-benefit analyses, communications tools, and other resources illustrating the potential for application of LCR.

As noted, most action on climate change will need to take place at the local government level, supported by the provincial and federal levels of government, through new policy, guidelines, regulations, and funding. Most municipalities have already embarked on emissions planning; many are now beginning to consider adaptation plans. Climate action is a process that is subject to continuous improvement, and the LCR approach can be introduced and mainstreamed at any stage of these processes. Over the next three years, ACT will work to translate these findings into the municipal and First Nations community contexts in collaboration with community partners, professionals, resource providers, and all levels of government.

1. INTRODUCTION

> "... integrating climate action at the local scale is a key pathway for accelerated action that can advance "rapid, systemic transitions."

The urgency to make the connection between reducing vulnerability (adaptation) and GHG emissions (mitigation) through low carbon resilience (LCR) approaches is on the rise. The Paris Agreement[1] notes the parallel importance of adaptation and mitigation, and the 2018 World Economic Forum's Global Risks report[2] cites the failure of adaptation and mitigation as one of the top global risks. The IPCC's 2018 special report[3] states that we have 12 years to get our emissions under control before we lock in warming of over 1.5 degrees Celsius – the tipping point after which small island states are inundated and climate impacts of much greater magnitudes begin to occur – and acknowledges the fact that we have now locked in a significant level of climate change to which we need to adapt.

The IPCC report notes that integrating climate action at the local scale is a key pathway for accelerated action that can advance "rapid, systemic transitions."[4] The report's guidance on key global actions includes prioritization of an LCR solution in the form of large-scale reforestation and ecosystem restoration due to potential for significant carbon sequestration. Ecosystem-based solutions are emerging as an adaptation response to stormwater and heat management in cities around the world with multiple co-benefits including carbon sequestration, and strategic implementation of these innovative urban planning approaches has the potential to benefit regional-scale ecosystem health.[5]

As we work to connect the dots between the two climate action streams, it will be possible to identify and prioritize many synergies and co-benefits that contribute to accelerated transformative change. This conclusion is also reflected in the 2018 IPCC Global Research and Action Agenda on Cities and Climate Change Science, which acknowledges that "mitigation and adaptation actions can compound each other. The potential co-benefits and synergies, as well as trade-offs, cancelation and carbon lock-in effects of such actions, are increasingly recognised."[6]

For example, LCR can include:

- Energy efficiency, distributed renewables, district energy systems, microgrids: ↓ GHGs, ↑ reliability, ↑ business continuity
- Green infrastructure: ↓ flood damage, ↓ heat island, ↓ building energy, ↑ pedestrian comfort

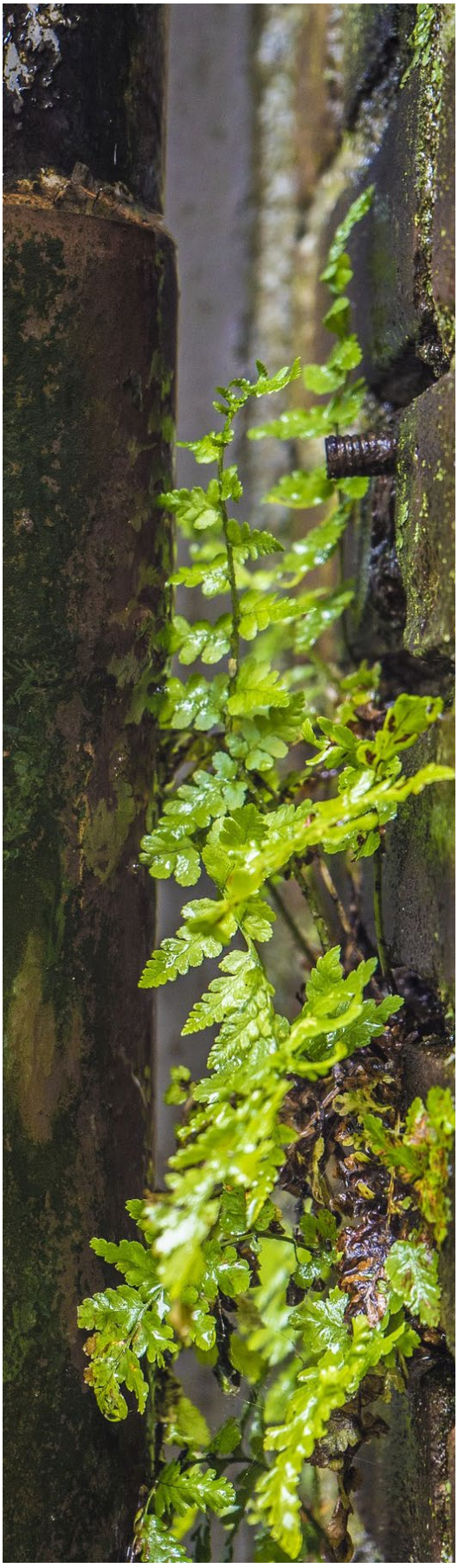
- Public transit flood protection, active transportation: ↓ GHGs, ↑ network efficiency & reliability
- Water use efficiency and wetland treatment: ↓ energy use, ↑ preparedness for floods & drought
- Low carbon resilient buildings: ↓ energy use, ↓ GHGs, ↑ business continuity, ↓ flood damage
- Climate smart agriculture: ↑ soil organic carbon storage, ↑ flood water retention, ↑ food[7]

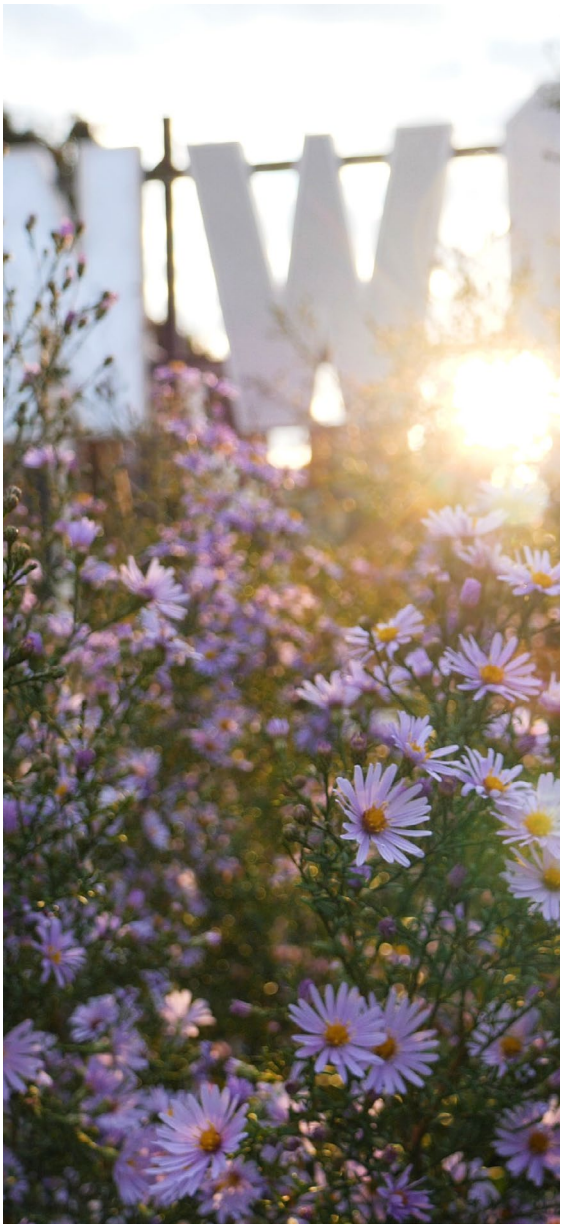
It is clear that integrating LCR approaches will require extensive collaboration between professions, all levels of government, citizens, stakeholders, and countries. In Canada, municipal action on LCR will be crucial to our success in meeting emissions targets as well as achieving national-level resilience to climate impacts, and alignment across all levels of government on policy and resources is needed to support this progress.

Communication is key to advancing LCR thinking and action. It is paramount that we improve our ability to communicate the reasons why decision-makers and voters alike should care about integrated climate action. We must express in tangible terms the benefits of LCR, the opportunities that will emerge, and the financial implications of acting, or choosing not to. More research is required to develop some of this analysis, but much of it already exists and is available to be mobilized by early adopters and climate action champions. For instance, LCR measures can:

- Achieve multiple co-benefits
    - Health, social, economic, biodiversity, and more
- Expand access to funding sources
    - Multiple benefits = multiple potential funders and investors
- Increase return on investments
    - In mitigation, adaptation and infrastructure
- Save time and resources
    - Integrated planning prevents duplication of efforts
    - Avoid missed GHG reduction opportunities and risk of building in future vulnerability
- Accelerate implementation and scale-up[8]

Given the challenges climate change poses, LCR must become a core lens through which to view all decision-making in the 21st century. Integrated climate action must be embedded as business as usual within all policy, planning, regulation, and professional practice. Achieving this will require LCR tools, practices and processes that can be used by all levels of government and professional sectors in their efforts to update education and training, codes and standards, funding and planning approaches, and to make widespread implementation of LCR both attractive and practical.





This report presents the results of a year-long project based on ACT's investigation into LCR over the prior two years[9,10] and the feedback from and priorities established by local, provincial and national professional sector representatives. The following deliverables are presented in Section 2 as standalone documents:

2.1: LCR Briefing Note – briefing for decision-makers;

2.2: LCR Concept Process Model, Diagram and Considerations – a conceptual model and diagram plus considerations illustrating aspects of the core LCR approach;

2.3: LCR Planning Example: OCP (Official Community Plans) and CCP (Comprehensive Community Plans) Processes – example #1 of how LCR might be mainstreamed into tools in common usage by professionals;

2.4: LCR Tool Example: The BC Energy Step Code – example #2 of how LCR might be mainstreamed into tools in common usage by professionals;

2.5: LCR Case Studies – examples of LCR in practice (a municipal action plan, a green infrastructure project, and a building design).

ACT worked with graduate research assistants at SFU and a team of expert advisers to develop these deliverables, which are designed as standalone items that can be printed out and used in a variety of contexts or used as part of the complete report. Because of this structure, background information on LCR is repeated in each of the above deliverables.

We also present preliminary findings on priorities established in the first round of discussions with professions including research on options and content for LCR training and Continuing Professional Development (CPD), and a draft database of resources offering guidance on LCR. These will be used in the next phase of this project as the foundations of a community partners network, further collaboration across professional sectors, and development of further resources designed to advance collaborative action on LCR.

> "Given the challenges climate change poses, LCR must become a core lens through which to view all decision-making in the 21st century.

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2. LCR DELIVERABLES

- 2.1: LCR Briefing Note
- 2.2: LCR Concept Process Model, Diagram and Considerations
- 2.3: LCR Planning Example: OCP (Official Community Plan) and CCP (Comprehensive Community Plan) Processes
- 2.4: LCR Tool Example: The BC Energy Step Code
- 2.5: LCR Case Studies:
    - 2.5.1 Green Infrastructure LCR Case Study: North Vancouver Rain Gardens
    - 2.5.2 Building LCR Case Study: Christus Spohn Hospital, Corpus Christi, Texas
    - 2.5.3 Municipal Plan LCR Case Study: City of Hamburg


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2.1. LCR
BRIEFING NOTE

This briefing note for decision-makers introduces the concept of low carbon resilience (LCR), and outlines advantages and co-benefits that can be gained by adopting the LCR approach.

BRIEFING NOTE: LOW CARBON RESILIENCE – THE CASE FOR INTEGRATED CLIMATE ACTION

This briefing note introduces the concept of low carbon resilience (LCR), or integration of climate change adaptation and emissions reduction, and outlines advantages and co-benefits that can be gained by adopting the LCR approach. It is intended to encourage individuals and organizations to begin thinking about how climate change mitigation and adaptation can be integrated in planning and action.

Key message: Strategically aligning climate adaptation and emissions reduction can enhance the effectiveness of both strategies, avoid risks, and generate economic, ecological, and social benefits.

"Strategically aligning climate adaptation and emissions reduction can enhance the effectiveness of both strategies, avoid risks, and generate economic, ecological, and social benefits.

Low Carbon Resilience (LCR) is the strategic integration of climate change adaptation and mitigation

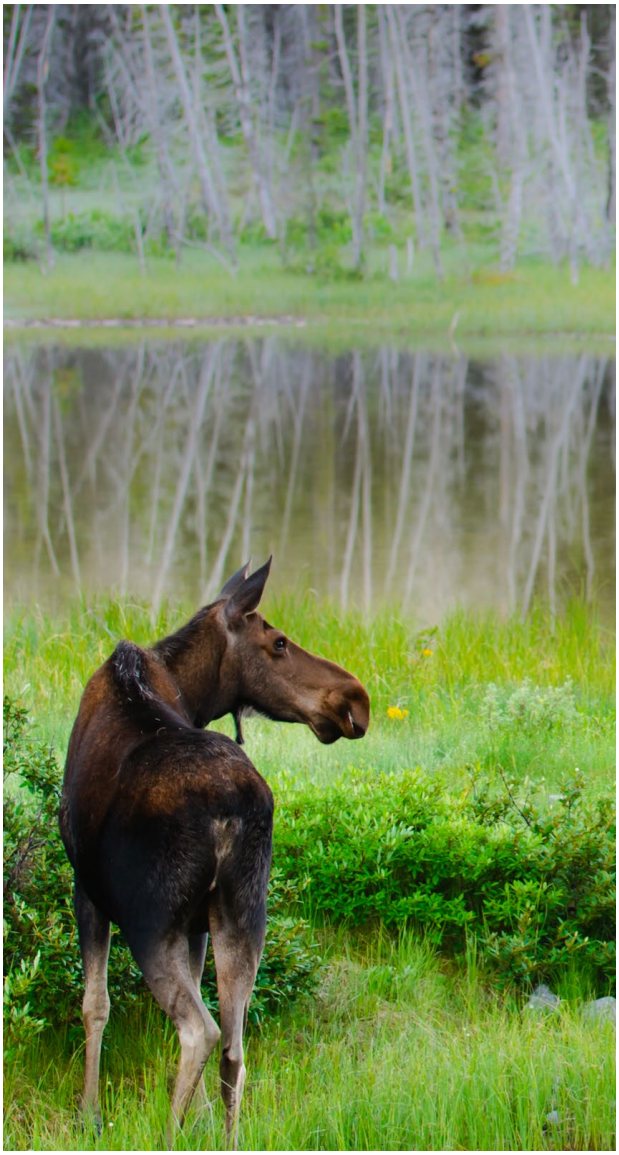
Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify in coming decades. Adaptation to these impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[1] The success of current emissions reduction efforts will determine the severity of future climate impacts, which are anticipated to escalate after 2050 if we do not reduce global emissions by ~80%, the goal of Canada's Mid-Century Strategy.[2] We must therefore plan responses to climate change impacts we cannot avoid (adaptation) while reducing emissions to minimize future impacts (mitigation).

To date, adaptation and mitigation have largely been planned separately. However, this siloed approach has the potential to increase emissions, build in vulnerability to climate impacts, and miss opportunities to achieve co-benefits associated with LCR approaches,[3] which also have the potential to drive transformative action. Working to connect, align and integrate the skills, tools, and funding currently being used to advance adaptation and mitigation separately has the potential to drive more effective results using less resources.

At the highest level, LCR is a lens that can be used to embed adaptation and mitigation at all levels of governance, planning and practice. It can be applied across

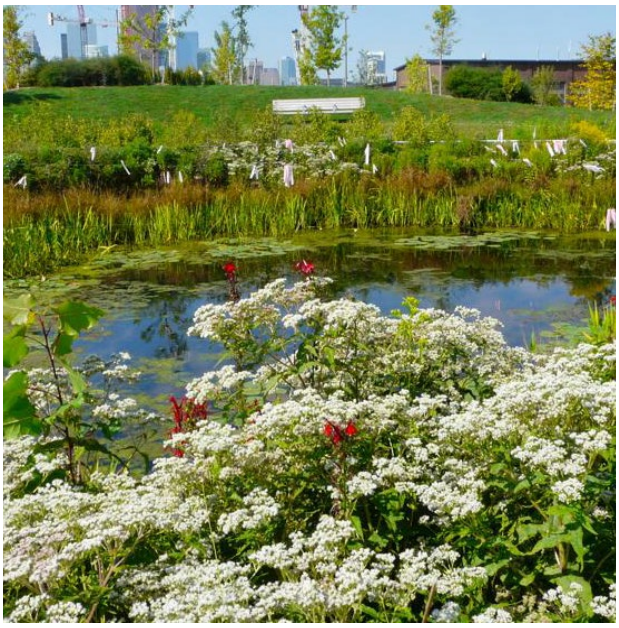
all sectors and within existing policies, tools and resources, and has the potential to incentivize sustainable land and water use. Many examples of LCR already exist or are emerging. For instance, transit-oriented development achieves LCR by decreasing tailpipe emissions and increasing residents' resilience through enhanced mobility.[4] Green roofs reduce emissions as well as urban heat and absorb stormwater. Permeable pavement is less emissions-intensive than asphalt and increases stormwater infiltration. Low-emissions microgrids enhance resilience through decreased reliance on centralized power sources. Ecosystem-based approaches to rainwater management and coastal resilience sequester carbon and reduce emissions while increasing resilience to heat, drought and flooding.[5] The value of natural assets such as forests and foreshores is being calculated in terms of avoided flood damages in the context of community capital assets, indirectly contributing to LCR.[6] Insurers are recommending wetland restoration to increase flood resilience at better value than more energy-intense options.[7] Such ecosystem-based LCR approaches provide multiple co-benefits for health and recreation, and can contribute to the robustness of property values.[8]

Key Recommendation: All levels of government in Canada need to embed low carbon resilience in policies and strategies to increase efficiency, achieve co-benefits, and reduce the economic, social and ecological risks associated with the current siloed approach to climate action. Governments can aid implementation of LCR by supporting development of pilot projects, as well as education and resources for students, professionals and communities.



Detailed Background

Canada's climate is warming more rapidly than the rest of the globe,[9] and global emissions continue to rise.[10] The changing climate is proving costly to the private sector, to the Canadian public and to all levels of government.[11] Disruptions due to flooding, wildfires and droughts, and their costs to Canadians' health, economic sectors and ecosystems will increase; all climate scenarios show that we are committed to some level of global temperature increase by 2050 with significant differences after this.[12] Canada's federal, provincial and territorial governments are reviewing climate plans and policies as a requirement of our status as a signatory to the UN Paris Agreement,[13] which aims to limit "global average temperature rise to 2°C above pre-industrial levels, and pursue efforts to limit the increase to 1.5°C," while acknowledging adaptation as a priority.[14] The Pan-Canadian Framework on Climate Change and Clean Growth establishes adaptation as one of four pillars of action,[15] and federal funding programs such as Infrastructure



Canada's Climate Lens[16] are beginning to require that applicants demonstrate consideration of both GHG emissions efficiency and climate resilience. Many municipal and regional governments are at a variety of stages of development of mitigation and adaptation plans.

The LCR Advantage

The risks associated with siloed climate change mitigation and adaptation planning include, for instance, loss of early adoption benefits such as cost savings, missed opportunities to identify synergies and access resources,[27] built-in vulnerability (e.g., energy-efficient buildings placed in floodplains), and the risk of maladaptation (e.g., adaptation efforts that increase emissions, such as construction of concrete seawalls in response to sea level rise, or increased air conditioning in response to extreme heat). LCR planning can help avoid these conflicts and manage trade-offs. To determine LCR benefits, integrated approaches should be quantitatively and qualitatively evaluated against stand-alone mitigation and adaptation policies.[18]

LCR Co-benefits

Integrating mitigation and adaptation has benefits that go beyond increasing resilience and decreasing emissions. Canadian municipalities are investing significant resources into both streams of climate action, and aligning these processes can save time and money, especially for those with limited capacity. The LCR benefits of protecting and restoring ecosystems are increasingly acknowledged and valued; e.g., the use of green infrastructure to reduce urban heat and absorb stormwater can also reduce GHG emissions. Protection and restoration of natural assets such as forests and foreshores contribute to reduced flood risks and costs with co-benefits for watershed integrity, human health, and the survival of biodiversity in a changing climate.[19] Recent research demonstrates that energy projects that integrate adaptation and mitigation increase access to resources and improve social licence by providing local benefits;[20] furthermore, the immediate advantages of reducing emissions (e.g. energy savings and improved air quality) complement the long-term benefits of adaptation. Integration therefore has the potential to reduce inaction due to the uncertainty inherent in projecting these future benefits.[21]

Conclusion:

Climate action plans at all levels of governance must evolve rapidly if Canada is to successfully respond to the need to both reduce emissions and build resilience to climate change impacts. LCR approaches can help drive this progress and avoid risks while achieving multiple co-benefits.

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2.2. LOW CARBON RESILIENCE **CONCEPTUAL PROCESS MODEL AND DIAGRAM**

The LCR Conceptual Process Model outlines how key steps in climate adaptation and mitigation planning processes might be aligned to achieve integrated action. The following LCR Diagram further provides a high-level overview and further considerations related to integrating climate change adaptation and mitigation into planning processes.

It is important to note that not only are climate adaptation and mitigation generally considered separately in professional and community contexts, but that climate action overall is still conceived of as separate from business-as-usual strategy, management, and operations. This work illustrates that integrated climate action – LCR – can and should be mainstreamed into all professional and governance policy and planning processes, and that this can be done at any stage of existing mitigation and adaptation plans.

LCR CONCEPTUAL PROCESS MODEL

The low carbon resilience (LCR) Conceptual Process Model illustrates how climate change adaptation and mitigation planning processes might be aligned, and suggests ways that key steps such as identifying co-benefits and cross evaluating emissions and vulnerability effects might be built into climate action project management.

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[1] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[2] Low carbon resilience (LCR) is a lens designed to achieve strategic systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date. Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[3] will help align climate action goals and advance the transition toward a more energy efficient, resilient, and sustainable future.

This model is intended to provide a starting point for discussion and can be modified to suit numerous contexts. The process is presented as sequential planning steps, as are two commonly used Canadian climate action resources: ICLEI Canada's Building Adaptive and Resilient Communities (BARC) Program and the ICLEI-FCM Partners for Climate Protection (PCP) Program. However, many practitioners will be building from existing plans or strategies and incorporating LCR in an iterative fashion. Climate planning is subject to ongoing continuous improvement, and benefits can be gained by beginning to integrate these steps at any stage. For instance, most municipalities have mitigation plans, but many are just starting on adaptation plans, and the LCR processes presented in this section can be applied when renewing mitigation plans. Practitioners

> "Climate planning is subject to ongoing continuous improvement, and benefits can be gained by beginning to integrate these steps at any stage.

considering this approach are encouraged to test, modify and adapt the process according to their needs and context.

Key Concepts and Terms

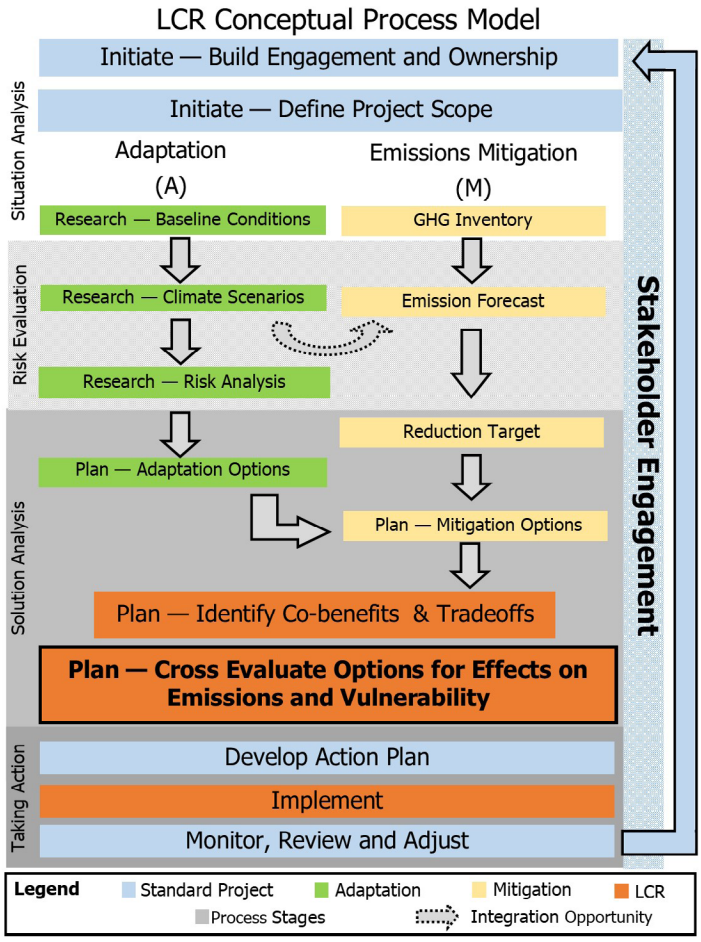
Stakeholder and community engagement should be considered throughout the process.

Baseline conditions are past weather-related events that affected or could have affected the proposed project. Thinking about the direct and indirect impacts of the current climate is a useful starting point for evaluating the projected impacts of climate change.

Assessing vulnerabilities and risks involves estimating sensitivity and exposure to projected climate impacts, assessing the resulting risks through analysis of the probability and magnitude of consequences, and determining the capacity to address them.

Co-benefits are the additional advantages of integrating adaptation and mitigation processes. These could include examples such as health benefits, support for biodiversity in ecosystem-based solutions, or time and money saved by combining mitigation and adaptation strategies.

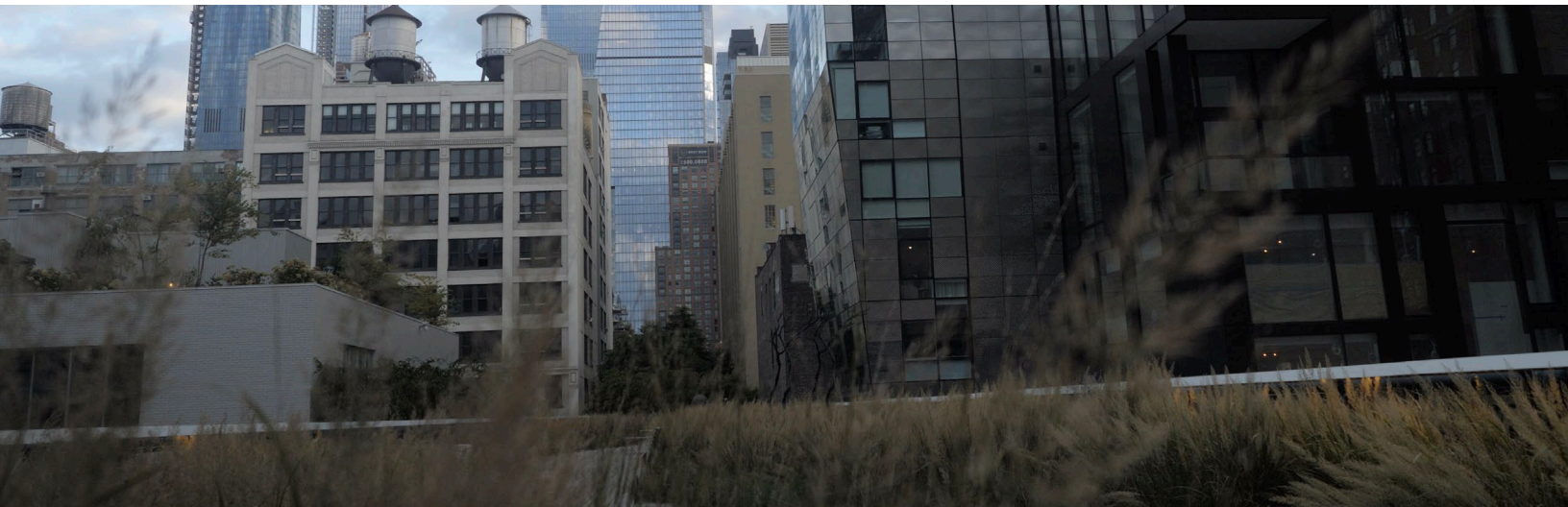
Cross-evaluating options for effects on emissions and climate vulnerability reductions minimizes conflict between adaptation and mitigation strategies. The LCR lens is designed to flag adaptation strategies that are highly emissions-intensive (e.g., concrete sea walls) and mitigation approaches that are exposed to climate impacts (e.g., energy-efficient buildings in a flood plain).



LCR Conceptual Process Model

Implementation includes not only on-the-ground development of solutions but also operationalization via decision-making processes and incorporation into existing plans, budgets and policies.

Evaluations and adjustments are necessary to ensure the LCR process continues to accomplish its objectives as conditions and knowledge evolve.



Milestone-based Planning Process

LCR DIAGRAM AND FURTHER CONSIDERATIONS

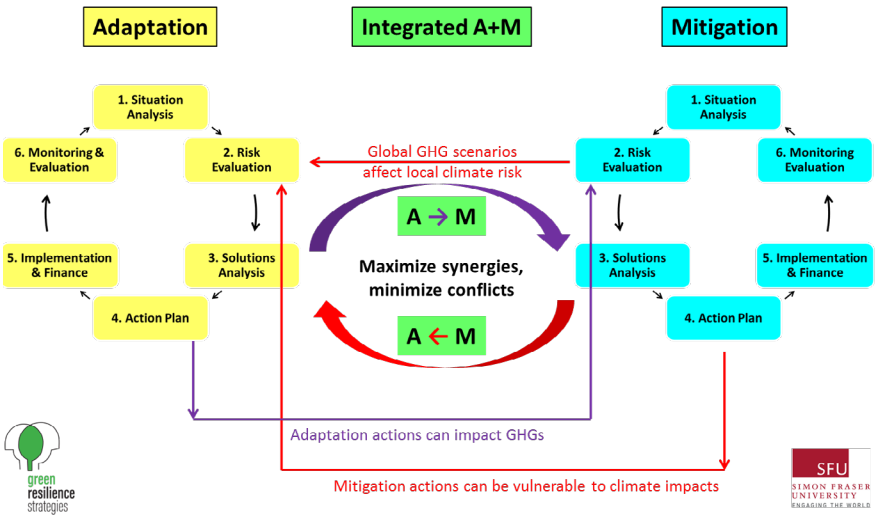
The following diagram presents another approach to a high-level overview of the process of integrating climate change adaptation and mitigation. It demonstrates how parallel efforts can be used to plan mitigation and adaptation strategies, identifies how these processes might interact with each other, and is intended to encourage decision-makers to think through how integrated action can be mainstreamed into existing planning processes. The six-step structure reflects stages in the two streams of climate action (starting with a pre-step of articulating the vision and defining the scope, boundaries, and timeframe). However, it is important to note that as this thinking evolves, integrated climate action should become embedded throughout all planning processes, rather than being pursued as independent adaptation and mitigation streams.

Adaptation and Mitigation Interactions

An essential part of LCR solution analysis is to identify potential interactions between and among adaptation and mitigation measures, including co-benefits and synergies as well as trade-offs and conflicts. Such an assessment can start with common-sense consideration of potential interactions ("Asking the Climate Question"), including seeking input from experts involved with action design and implementation and stakeholders impacted by the climate action. Existing analytic tools (e.g., flood mapping and GHG emissions models) can be applied to determine the GHG and vulnerability/resilience impacts of various climate actions. ICLEI's Building Adaptive and Resilient Communities (BARC) Framework includes prioritization of adaptation measures that have GHG reduction potential, or offer other mitigation co-benefits. Professionals would benefit from checklists and comprehensive inventories of potential adaptation and mitigation interactions, as well as potential solutions to maximizing GHG and resilience benefits.[4] There is also a need for quantitative tools to analyze potential conflicts and synergies among adaptation and mitigation actions.[5]

While actions specifically targeted to mitigation or adaptation can provide significant benefits, other broader activities, such as infrastructure spending and land use planning, can have much greater impacts – either negative or positive – due to their larger scale or broader scope. Therefore, it is important to "Ask the Climate Question" of broader processes, plans

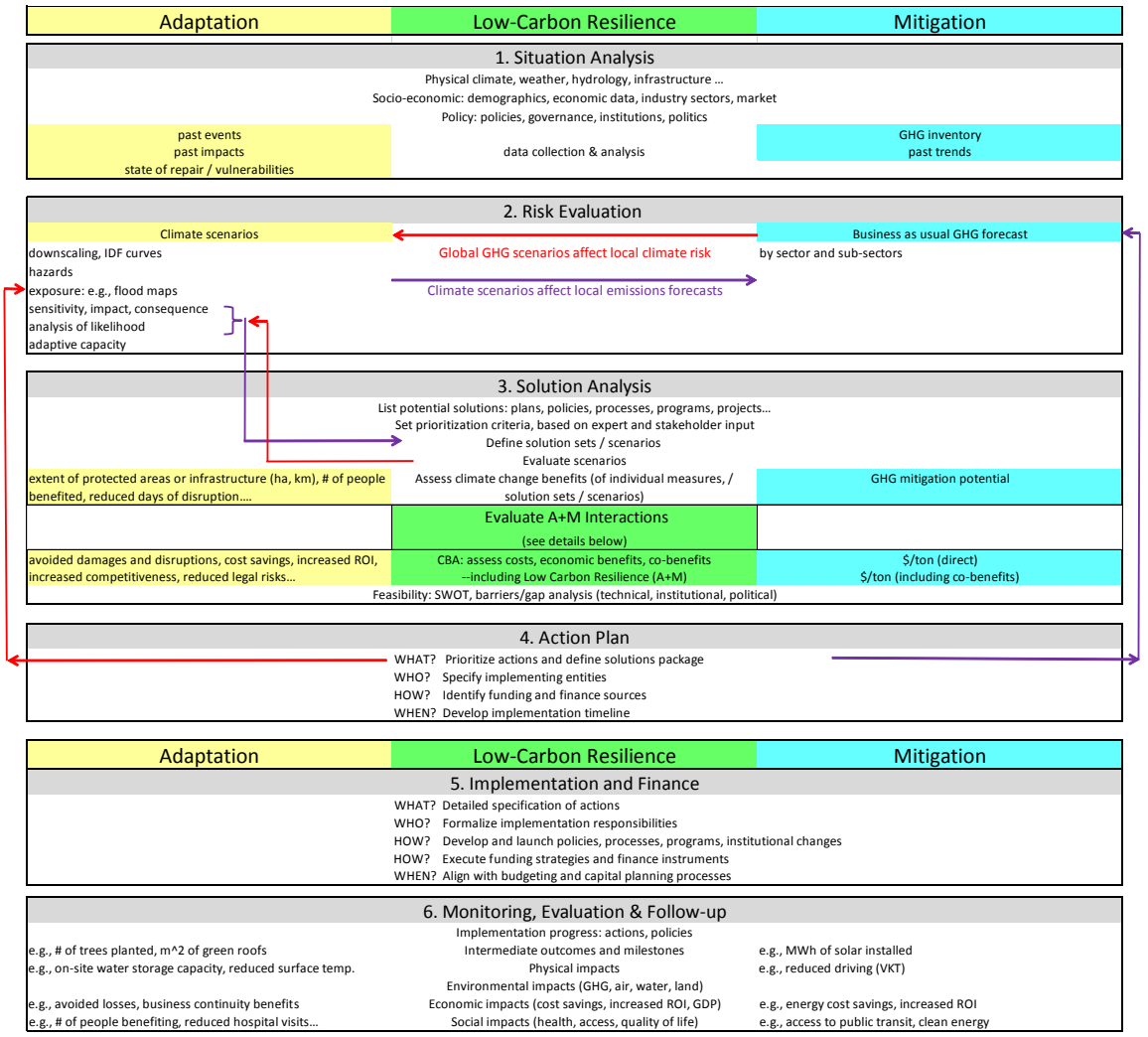
Connecting Adaptation and Mitigation Milestone-based Processes



and financial decisions that may have implications for adaptation and mitigation. This should include review of physical plans (land use, infrastructure, energy, transportation, water systems, flood management ecosystem protection, etc.), as well as financial plans (annual budgets, capital, operations and management, etc.) and asset management strategies.

Matrix: Integrating Climate Change Adaptation and Mitigation Planning and Action Process Steps

This annotated matrix provides examples of diverse process steps for integrated climate change adaptation and mitigation planning and action, and how they might be connected in an LCR approach, in more detail.



END NOTES

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2 Environment and Climate Change Canada. (2016). Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy.

3 Nichol, E. and Harford, D. (2016). Transformative Climate Change Planning for Canada. ACT, SFU: Vancouver, BC.

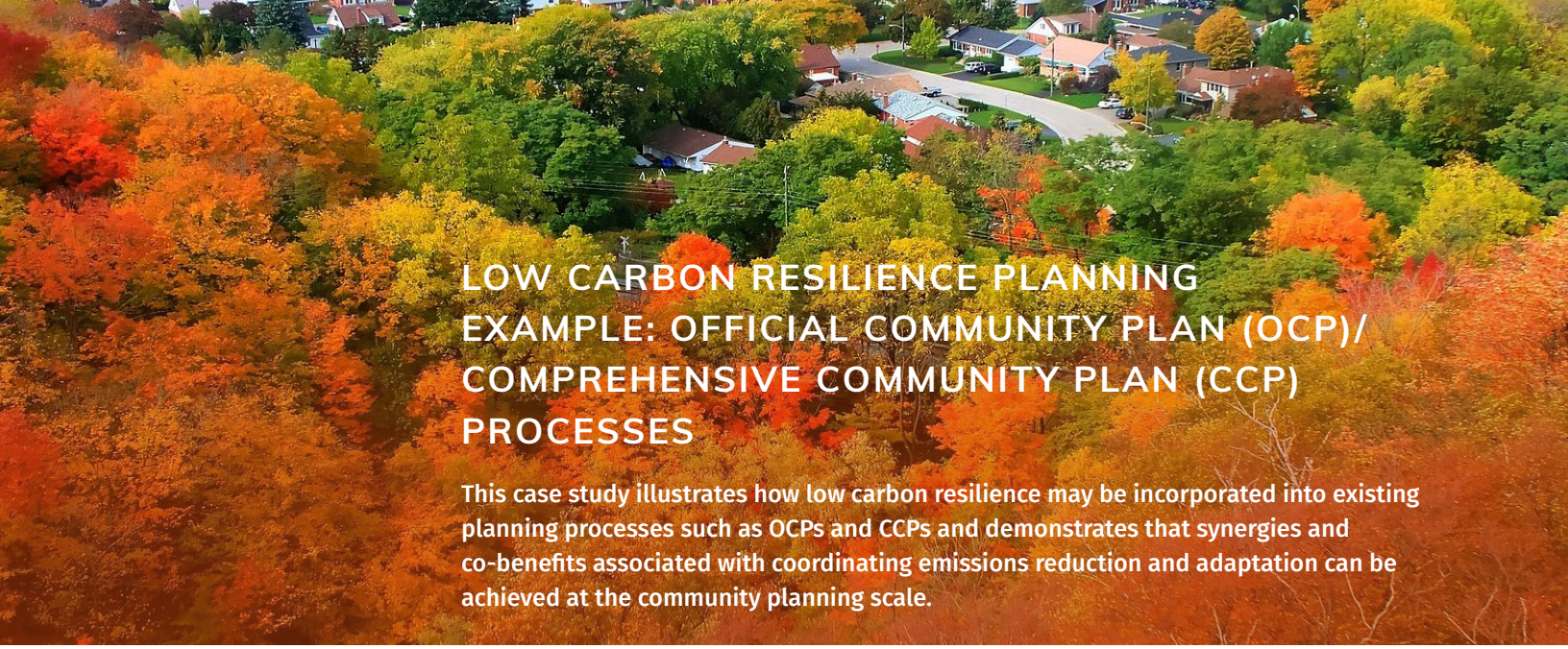
4 The C40 Adaptation and Mitigation Interaction Assessment Tool (AMIA) provides initial qualitative assessment of A-M interactions.

5 Green Resilience Strategies has developed a concept for such a tool – the A+M Toolkit.


ACT (ADAPTATION TO CLIMATE
CHANGE TEAM)

2.3. LOW CARBON RESILIENCE PLANNING EXAMPLE: **OCP (OFFICIAL COMMUNITY PLAN) AND CCP (COMPREHENSIVE COMMUNITY PLAN) PROCESSES**

Low carbon resilience (LCR) is intended to be a broadly applied approach, or lens. This case study illustrates how LCR might be incorporated into existing planning processes such as OCPs and CCPs, and demonstrates that synergies and trade-offs between reducing emissions and building resilience can be mainstreamed into planning at the community scale.



LOW CARBON RESILIENCE PLANNING EXAMPLE: OFFICIAL COMMUNITY PLAN (OCP)/ COMPREHENSIVE COMMUNITY PLAN (CCP) PROCESSES

This case study illustrates how low carbon resilience may be incorporated into existing planning processes such as OCPs and CCPs and demonstrates that synergies and co-benefits associated with coordinating emissions reduction and adaptation can be achieved at the community planning scale.

Background

Climate change is driving environmental, social, health, and economic challenges for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all greenhouse gas (GHG) emissions today.[1] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[2] Low carbon resilience (LCR) is a lens designed to achieve strategic systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date. Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[3] will help align climate action goals and advance the transition toward a more energy efficient, resilient, and sustainable future.

Communities require integrative frameworks that can assist them in developing LCR policies.[4] This scan of the OCP and CCP processes pulls together resources and components from existing tools and case studies to start to explore how LCR might be adopted into community plans and strategies. The examples used are existing policies in OCPs or CCPs that reflect plans either focused separately on mitigation and adaptation, or that use an integrated approach. They represent mandated and/or recommended considerations for particular developments within particular host communities.

> "Communities require integrative frameworks that can assist them in developing LCR policies.

Official Community Planning

An Official Community Plan (OCP) is intended to set a vision for a community for 5-20 years. Municipalities are encouraged to pursue planning processes that engage community members and government officials in establishing objectives and policies on land use, community development and operations. Communities then develop legally binding bylaws that support the OCP. Bylaws represent an area of opportunity for achieving LCR by identifying co-benefits and areas where adaptation and mitigation actions are mutually supportive.

Increasing community resilience to climate change impacts can be accomplished through taking a long-term approach to planning. The Government of British Columbia

encourages incorporating climate change adaptation into OCPs.[5] This is currently being achieved by most municipalities through a climate action section that generally treats adaptation and mitigation separately. Furthermore, most municipalities now have mitigation plans, but many are just starting on adaptation plans.

Adopting policies that build adaptive capacity into infrastructure and energy systems is an increasingly essential part of the planning process. This includes preserving and enhancing the natural environment and planning to minimize the impacts of extreme weather events, locating development away from hazardous areas, and developing site-specific recommendations for development or redevelopment, including energy efficiency, the incorporation of natural assets, and opportunities for renewable energy.[6]

The LCR approach can be used to assist in formation of climate action-oriented bylaws and other guidelines that consider adaptation and mitigation simultaneously within OCPs. Establishment of Development Permit Areas is one example of an existing OCP opportunity to enact mandated or recommended LCR-based approaches.

Development Permit Areas:

Development Permit Areas (DPAs) provide municipalities the opportunity to determine specific requirements or suggested standards for development or redevelopment within designated areas. A DPA includes site-specific considerations that all development applications are required to meet. The *Local Government Act (*ss.919.1-920) enables a local government, through its OCP, to designate areas based on factors such as, but not limited to, wildfire, flood and slope hazards as well as stormwater management, biodiversity and reductions in greenhouse gas (GHG) emissions.[7] DPAs provide a set of guidelines that are applied when a development permit is requested and could be used to mandate or require that integrated climate action be considered/included in areas such as landscaping, siting of buildings, elements of form and exterior design of buildings, and specific features relating to the development and machinery, equipment and systems external to buildings and other structures.[8]

DPAs represent an opportunity for municipalities to incorporate climate action into the legislative authority of local governments.[9] The site-specific nature of DPAs also provides an opportunity to integrate LCR thinking, with the potential to develop strategies and plans that enhance the resilience of a community through adaptation as well as consider reductions in emissions. Municipalities can use DPAs to apply LCR by using their authority to recommend or mandate that vendors and/or developers identify co-benefits and opportunities for integrated climate action in development and re-development applications. A number of communities have used DPAs to embed climate action, usually using either an adaptation or mitigation lens, within their OCP process; e.g., the District of North Vancouver's *Energy and Water Conservation and Greenhouse Gas Emissions Reductions DPA* encourages developers to use an integrated, performance-based approach to reduce energy and water consumption and GHG emissions while improving occupants' comfort and safeguarding health.[10]

There are many other opportunities for integration of LCR in DPAs, which could for example require that near-shore developments provide soft-infrastructure defenses against storm surges and sea level rise, such as the approach advanced by Green Shores,[11] while also requiring them to locate energy-efficient power supply infrastructure above specified Flood Construction Levels (FCLs) to protect against flooding.[12]

Comprehensive Community Planning: Phase 4 – How will we get there?

The 4th phase of the Comprehensive Community Planning (CCP) process, developed by Indigenous and Northern Affairs Canada in partnership with BC First Nations,[13] directs

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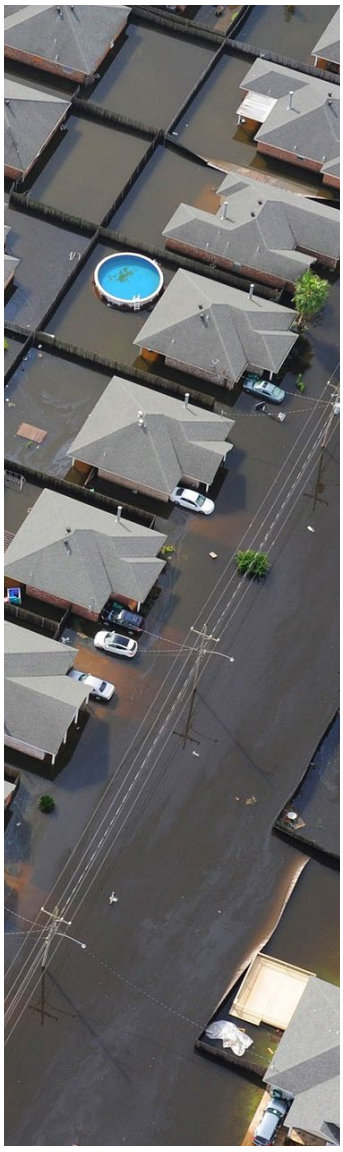

community planners and organizers to consider how the community will reach goals identified in the first three planning phases.[14]

In the third phase ("Where do we want to go?"), CCP planners are advised to consider asking the following questions:

- What climate change-related events have we noticed in our community?
- What are the priority areas we must consider related to the expected impacts from climate change?
- What climate change-related weather events can we anticipate seeing more of?
- What ideas do community members have that may help reduce the impacts of climate change?
- What have other communities done to reduce their vulnerability and how can we develop our own action plans?

Applying the LCR model to identify priority actions in Phase 4 could therefore produce plans that effectively integrate adaptation and mitigation. For example, the Westbank First Nation established a set of Sustainability Principles as part of its CCP process, identifying action areas that reflect the holistic relationship between the Four Food Chiefs: Black Bear (Governance), Spring Salmon (Economy), Bitterroot (Land), and Saskatoon Berry (Community). Principles within those areas include: Conserve sloped areas of greater than 30% grade in a natural state; support energy-conscious community planning and building design; explore alternative energy sources; and retain significant vegetation and trees native to sites. These principles are coupled with action plans within the CCP such as the development of a sustainability checklist; the creation and adoption of a plan to reduce GHG emissions on Westbank First Nation lands; and the development of a tree preservation policy.[15]

This action-focused planning process offers an opportunity for community organizers and leaders to apply LCR thinking. For example, they might identify projected high surface and air temperature areas and require planting and/or protection of tree species in these neighbourhoods to reduce the urban heat island effect, while reducing the amount of energy required to cool buildings in summer months.[16] The Westbank First Nation is currently considering a sustainability plan to develop holistic and actionable items that reduce both emissions and vulnerability.

Environmentally Sensitive Areas:

Environmentally Sensitive Areas (ESAs) are a tool in the CCP process that could be used to advance LCR in a similar way to DPAs in the OCP process. CCPs offer an opportunity for communities to identify ESAs of land or water that may be sensitive to human presence, activities or land development or maintain significant and/or cultural natural asset values, and establish bylaws that govern the use of, and development within, these areas.[17] Establishing criteria for the development of guidelines to undertake such an environmental assessment represents a significant opportunity for First Nation communities to adopt the LCR model.

For example, the Anticipating the Future section of the Official Land Use Plan of the Tla'amin Nation identifies local climate change impacts, including increased water temperatures, forced species migration, changes in weather, and sea level rise, and uses these projections to create action items designed to manage exposure to risk and reduce energy and water use.[18] For example, in order to reduce emissions, Schedule B: General Land Use Designation recommends locating most housing within walking

distance of commercial and community services. To prepare for sea level rise, Schedule D-2: Hazard Area Guidelines recommends a 30-metre setback from the high-water mark to protect future developments. In order to protect ecological features, Schedule D-1: Sensitive Areas Guidelines recommends the protection of environmentally sensitive areas, e.g., riparian corridors and wetlands.[19]

The CCP General Land Use, Hazard Area and Sensitive Area Guidelines also represent opportunities for integration of LCR development. The appropriate setbacks and requirements are context dependent and should be set in each plan according to local climate projections and vulnerabilities.

ESA guidelines could also, for example, recommend or mandate that developments include green infrastructure and natural assets that achieve LCR and consider biodiversity and ecosystem health in order to provide habitat for climate change-induced species migration.

> "The Westbank First Nation is currently considering a sustainability plan to develop holistic and actionable items that reduce both emissions and vulnerability.

Co-Benefits Potential of LCR:

Application of the LCR model to OCP and CCP components such as DPAs and ESAs has the potential to produce a number of co-benefits. For instance, greater attention to soft-infrastructure adaptation approaches in the foreshore, wetlands, or as street shading in communities, not only minimizes emissions associated with infrastructure development and extreme weather impacts, but also increases biodiversity habitat and survival, improves human health, increases property values, and streamlines financial and human capital costs.[20]

END NOTES

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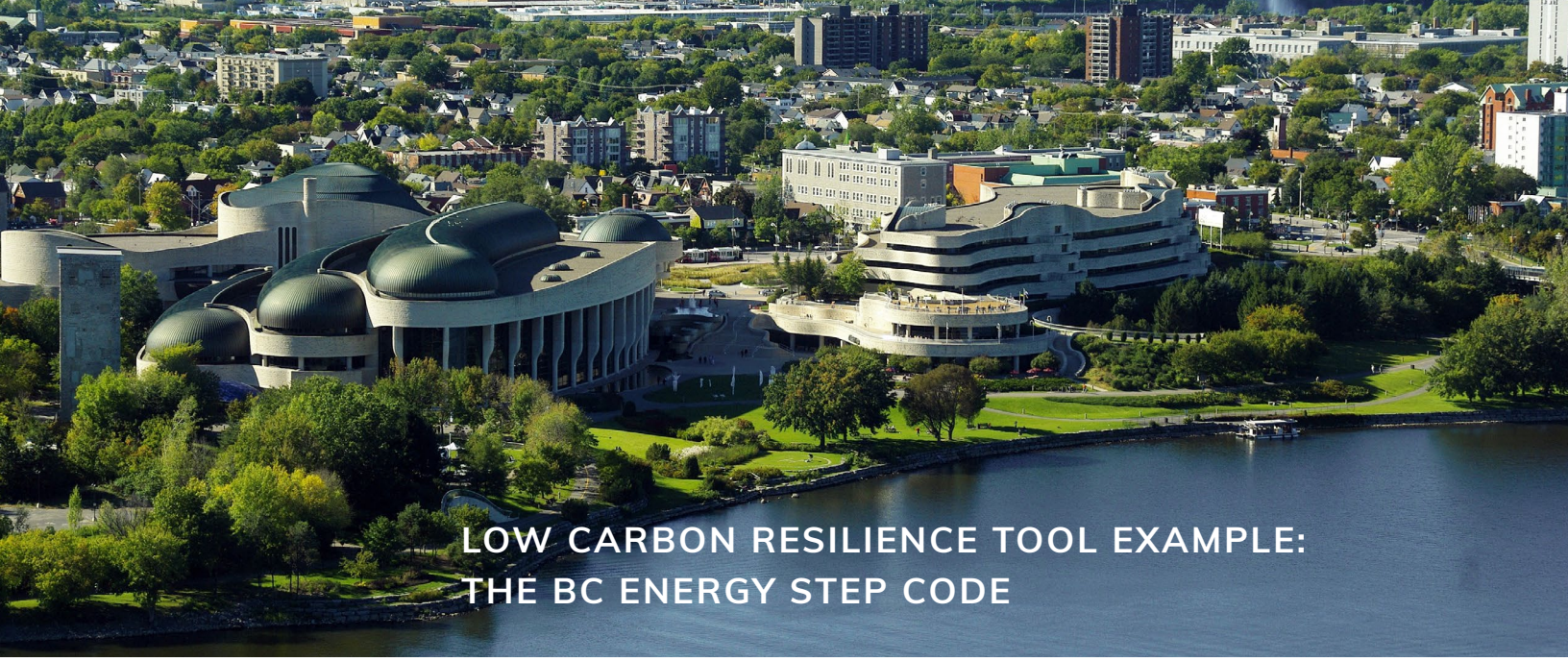
2.4. LOW CARBON RESILIENCE TOOL EXAMPLE: **THE BC ENERGY STEP CODE**

This case study illustrates how low carbon resilience (LCR) might be incorporated into an existing tool, the BC Energy Step Code. It demonstrates that synergies and trade-offs between reducing emissions and building resilience can be achieved at the building scale, and highlights how practitioners using the code might increase efficiency and effectiveness by considering future climate in building design and operation.



LOW CARBON RESILIENCE TOOL EXAMPLE: THE BC ENERGY STEP CODE

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Low Carbon Resilience and Buildings

Climate change has already altered temperature and precipitation patterns in BC and these trends are expected to intensify in coming decades[1] Buildings must be designed with BC’s current and future climate in mind if they are to meet energy efficiency goals. The Energy Step Code is an important advance in the Government of British Columbia’s strategy to reduce greenhouse gas emissions; however, it does not currently incorporate projected climate impacts. Taking an LCR approach by considering climate change adaptation and emission reduction in a single integrated process could improve the future performance of buildings being planned and assessed using the Energy Step Code.

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all greenhouse gas (GHG) emissions today.[2] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada’s Mid-Century Strategy.[3] Low carbon resilience (LCR) is a lens designed to achieve strategic systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date. Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[4] will help align climate action goals and advance the

transition toward a more energy efficient, resilient, and sustainable future.

The BC Energy Step Code

The Government of British Columbia created the Energy Step Code in 2017 to improve the energy efficiency of newly constructed and retrofitted buildings.[5] The code is intended to reduce the greenhouse gas emissions generated by building operations, with the ultimate goal of constructing "net zero energy-ready" buildings by 2032.[6] The code establishes five steps based on a series of measurable, performance-based indicators.[7] The first step introduces energy performance modelling and air tightness, but only requires compliance with the standards in the basic BC Building Code, while Step 5 requires a "net-zero energy ready" standard that only today's most efficient buildings can meet.[8]

The code is not provincially required – builders and communities can choose to opt in to its performance standards. However, some BC municipalities have already passed bylaws requiring specific steps be met;[9] for example, the Township of Langley, the City of Victoria and a number of communities across the province are adopting the code for certain categories of buildings.[10] In December 2017, the City of North Vancouver became the first municipality to require all new buildings to use the BC Energy Step Code.[11]

Buildings & Climate Change Adaptation

There are two main ways climate change adaptation might be considered in building design, construction, and energy use for the duration of the intended life of the building. The first is to ensure buildings are resilient to climate change impacts such as increased temperature and extreme weather events, altered precipitation and flooding patterns, sea-level rise, and other challenges, while remaining healthy places for occupants. The second is to ensure that technologies and techniques to advance energy efficiency are adaptive and continue to be effective as the climate changes. Both are important challenges that can be addressed with an LCR approach. The following sections highlight approaches to addressing the second challenge: adaptive energy efficiency.

Maintaining Energy Efficiency in a Changing Climate

Practitioners designing and constructing buildings need to consider the effects of climate change on building performance over the duration of the intended life of the building. Since buildings typically last 60+ years, it is crucial to incorporate future climate change projections such as increases in

temperature into weather data used to assess design and planned performance.[12]

This is becoming an important step in ensuring that buildings will continue to perform as expected over their lifetime as climate change will significantly alter heating and cooling demand patterns. Warming may be significant enough to shift peak energy demand in the Pacific Northwest from winter heating to summer cooling.[13] An LCR approach to this challenge requires ensuring that buildings are planned and retrofitted in ways that acknowledge changing temperatures and avoid increasing emissions.

Building design professionals could use a variety of strategies to meet these objectives. Integrating adaptation with emissions reduction requires reconsideration of conventional building design elements, such as reliance on air conditioning for cooling,[14] an important factor in BC, where rising average and daily maximum temperatures are expected to increase demand.[15] Design elements can be borrowed from pre-air-conditioned buildings, including evaporative cooling and solar chimneys, and taking advantage of lower nighttime temperatures for night-flushing.[16] The necessary cooling loads can be reduced with external albedo-increasing colour selection, strategically placed vegetation, and taking advantage of prevailing winds and the presence of water for evaporative cooling.[17]

Passive building design is another approach that can be used to adapt to increased temperatures while ensuring emissions reduction efforts remain effective. Passive design practices include increasing thermal mass, insulation, external shading and cross ventilation.[18] Buildings designed to operate passively can also incorporate alternative cooling technologies, utilize waste heat appropriately, and support measures (such as strategically placed vegetation) to reduce the urban heat island effect.[19] However, research suggests that passive cooling will likely not be sufficient as buildings become more air tight and efficient, and that some level of active cooling will likely be needed, necessitating a focus on highly efficient heat pumps, ventilators and other measures.[20]

> “Integrating adaptation with emissions reduction requires reconsideration of conventional building design elements, such as reliance on air conditioning for cooling ...

Using the Energy Step Code to Prepare for Future Climate

Practitioners could consider including climate change adaptation in the Energy Step Code to ensure future climate is considered in the design of new buildings and retrofits. Two examples follow of Energy Step Code components in which practitioners could incorporate projected temperature changes:

1. Building energy modelling: Including climate change projections in the thermal performance of buildings.[21] Practitioners could consider projected temperature changes when completing the modelling required under the first step of the code as the new practice normal, helping to ensure buildings continue to meet energy efficiency targets as temperatures increase. This approach is already being advanced by the City of Vancouver and the province of BC.
2. Consideration of the number of heating degree days (HDD) and cooling degree days (CDD) for which a building is designed. The Energy Step Code's requirements differ across the province based on BC's climate zones,[22] which are based on

the number of HDDs each year,[23] i.e., how much heating is needed to maintain a consistent temperature. Climate change has already altered the average number of HDDs and CDDs in BC,[24] and these shifts may become a significant factor in energy demand in coming decades.[25] Practitioners can build off the Energy Step Code's requirements to better prepare for climate change by considering their region's projected HDDs and CDDs in the design and operation of buildings.

Next Steps

Practitioners and policy-makers adopting the BC Energy Step Code are making an important commitment to climate action by ensuring buildings are designed and constructed to increase energy efficiency and decrease emissions. However, it is also important to consider future climate conditions over building lifetimes. Taking an LCR approach to the Energy Step Code would allow emission reduction and climate adaptation goals to be integrated into a single decision-making process that ensures buildings continue to be energy efficient as the climate changes.

"Taking an LCR approach to the Energy Step Code would allow emission reduction and climate adaptation goals to be integrated into a single decision-making process that ensures buildings continue to be energy efficient as the climate changes.

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2.5. LOW CARBON RESILIENCE **CASE STUDIES**

2.5.1 Green Infrastructure LCR Case Study: North Vancouver Rain Gardens

This case study provides an example of a municipal-level ecosystem-based approach to sustainable land and water use that demonstrates LCR benefits.

LOW CARBON RESILIENCE CASE STUDY: CITY OF NORTH VANCOUVER RAIN GARDENS

This case study provides an example of a municipal-level ecosystem-based approach to sustainable land and water use that has low carbon resilience (LCR) benefits.

> "
> ... over their lifecycle, rain gardens produce 30-90% fewer emissions than conventional stormwater management alternatives.

Green Infrastructure-Based Stormwater Management Using Rain Gardens

Rain gardens are small naturalized areas designed to manage rainfall by providing infiltration opportunities and slowing entry into a city's conventional stormwater infrastructure or natural water bodies. The City of North Vancouver has installed approximately 50 rain gardens as part of its water management strategy.[1]

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[2] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[3] Low carbon resilience (LCR) is a lens designed to achieve strategic and systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date.[4] Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[5] will help align climate action goals and advance the transition toward a more energy efficient, resilient and sustainable future.

North Vancouver's Rain Gardens

Metro Vancouver's North Shore municipalities, including North Vancouver, have partnered with university researches and community members for a rain gardens pilot project,[6] with the first stages of the research focusing on community involvement and

implementation and future stages focusing on the benefits of rain gardens.[7] North Vancouver's rain gardens project demonstrates that green infrastructure can provide LCR benefits. Green infrastructure is a broad category that includes natural assets (e.g., wetlands), enhanced assets (e.g., stormwater ponds), and engineered assets (e.g., green roofs).[8] It harnesses services provided by natural and naturalized areas to replace or augment the role of human-made infrastructure in water filtration, flood absorption, and other services.[9] Widespread implementation of rain gardens will help prepare North Vancouver for climate change impacts by augmenting the capacity of conventional stormwater management infrastructure, while avoiding the need to upgrade existing drainage infrastructure and/or process stormwater using GHG emissions-intensive processes. The LCR benefits include reductions in emissions and infrastructure costs, and reduced vulnerability to climate impacts.

Climate Change Adaptation Benefits

Stormwater management – Metro Vancouver has identified stormwater management as a key focus for municipal climate change preparedness.[10] Rain gardens and other forms of green infrastructure can help North Vancouver cope with climate change impacts such as increased rainfall by reducing the presence of impervious surfaces that contribute to peak flows entering traditional stormwater infrastructure and enhancing water absorption. Extreme precipitation events may still overwhelm green infrastructure systems, so these solutions must be planned in tandem with grey infrastructure and flood preparedness.

Local climate control – The average number of very hot days (above 30°C) in Metro Vancouver is projected to increase from 1.2 per year in 2018 to 13 per year by 2051-2080.[11] Natural areas have a cooling influence that can counter the urban heat island effect caused by factors such as human-made surfaces, building heights, and heat emitted by traffic and industrial processes in cities. Green infrastructure can play a beneficial role for human and wildlife health through reducing temperatures.[12]

Flood risk reduction – Increasing water infiltration through permeable surfaces reduces runoff, aiding in minimizing local and sometimes regional flood risk.[13]

> Extending the life of existing stormwater infrastructure by supplementing with green or 'soft' infrastructure approaches has the potential to significantly reduce greenhouse gas (GHG) emissions.

Climate Change Mitigation Benefits

Avoiding emissions – Extending the life of existing stormwater infrastructure by supplementing with green or "soft" infrastructure approaches, thus avoiding or delaying the need for carbon-intensive concrete infrastructure replacement, has the potential to significantly reduce greenhouse gas (GHG) emissions. Green infrastructure also helps lower emissions through reduced energy demand for stormwater collection, pumping, filtration and treatment, as well as natural cooling for surrounding infrastructure, reducing the need for air conditioning.[14] Research suggests that, over their lifecycle, rain gardens produce 30-90% fewer emissions than conventional stormwater management alternatives.[15]

Carbon storage – Vegetation in rain gardens, and downstream ecosystems benefitting from their presence, contribute to emissions reductions by absorbing and storing carbon.

LCR Co-benefits

Cost savings – The green infrastructure approach reduces costs associated with installing and maintaining traditional infrastructure, with the additional value of sequestering carbon locally rather than purchasing carbon offsets. A comparison of grey and green infrastructure approaches concluded that rain gardens reduced costs by 42% over their life cycle.[16]

Water and Air-related Benefits:

Water quality protection – Green infrastructure acts as a natural filter by intercepting pollutants such as oil, fertilizers, pesticides, sediments, and chemicals that would otherwise enter streams, rivers and lakes, helping to protect aquatic and non-aquatic species and prevent drinking water contamination. Protecting salmon habitat was an important motivation for North Vancouver's rain garden project.[17]

Groundwater recharge – Rain gardens increase rainfall infiltration while reducing runoff.

Improved air quality – Augmenting green space filters particles and pollutants via evapotranspiration.

Ecological Benefits:

Biodiversity – Naturalized spaces increase biodiversity habitat and contribute to opportunities for establishing green corridors that can help nurture wildlife species survival in a changing climate.

Pollination – Urban vegetation can support species of birds, bats and bees that play a crucial role in pollination and seed dispersal.

Human Benefits:

Noise reduction – Vegetation has been shown to absorb soundwaves and reduce noise levels.

Amenity value – Green infrastructure provides aesthetic benefits, including recreational amenity spaces that increase the overall wellbeing of the community. Accessible natural environments encourage walking, cycling, and spending time outside, contributing to community health and the protection of downstream recreational swimming and fishing areas.

Health – Natural green areas have benefits for physical, psychological, and respiratory health through improved air and water quality, opportunities for recreation, and cultural and spiritual benefits.

Pedestrian safety – North Vancouver's rain gardens are making their locations more pedestrian-friendly.[18]

Natural assets – Green infrastructure illustrates the value of natural assets, providing infrastructure redundancies and increasing community resiliency. For example, water bodies in or nearby the community can serve as both stormwater filtration ponds and back-up emergency sources of non-potable water.

Key Resources

Best management practices for rain gardens and other forms of green infrastructure:
City of Vancouver (2016). Best Management Practice Toolkit: Volume II. Retrieved from https://vancouver.ca/files/cov/integrated-stormwater-management-best-practice-toolkit-volume-2.pdf

Cost-benefit analysis for evaluating the monetary and non-monetary effects of rain gardens as a form of green infrastructure:
Erlandsen, A. M., Vennemo, H., Skjeflo, S. W. (2017). Cost-Benefit Analysis of Climate Change Adaptation Projects. Vista Analyse, CLIM CITIES & Iceland, Liechtenstein Norway grants. ISBN 978-82-8126-343-7.

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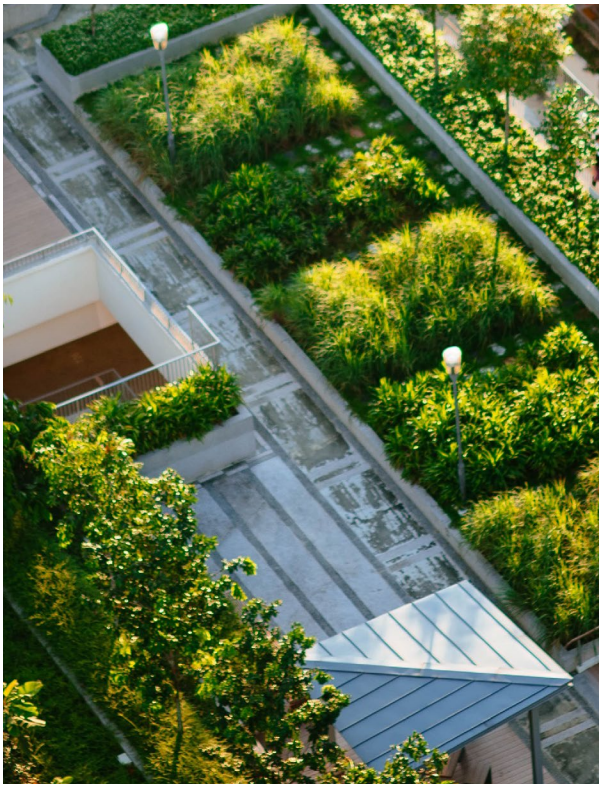
2.5.2 Building LCR Case Study: Christus Spohn Hospital, Corpus Christi, Texas

This case study provides an example of an LCR-based approach to building design and development.



LOW CARBON RESILIENCE CASE STUDY: CHRISTUS SPOHN HOSPITAL, CORPUS CHRISTI, TEXAS

LCR and Health Infrastructure

The Christus Spohn Hospital case study provides an example of a low carbon resilience (LCR) approach to construction and operation of a major health facility. It illustrates building elements that can be used to align emissions reductions and adaptation goals, and how strategic planning in this regard have contributed to one building's design, construction and operation. This case study provides an existing example of how LCR can be used to reduce emissions and strengthen both building and community resilience to climate change impacts.

> "Since buildings typically last 60+ years, it is important to consider projected climate change impacts when assessing their design and performance ... [and] minimize the emissions a building will contribute over its lifespan.

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[1] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[2] Low carbon resilience (LCR) is a lens designed to achieve strategic and systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date.[3] Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches[4] will help align climate action goals and advance the transition toward a more energy efficient, resilient, and sustainable future.

Christus Spohn Hospital

The LCR approach can be applied to most fields of practice, including building design. Since buildings typically last 60+ years, it is important to consider projected climate change impacts when assessing their design and performance.[5] It is equally important to minimize the emissions a building will contribute over its lifespan. The Christus Spohn Hospital case study provides an example of a building with consideration for climate change incorporated into all aspects of its design and function.

Part of the largest hospital system in South Texas,[6] Christus Spohn comprises three facilities with a total of 1,056 patient beds[7] and a new 42,000-square-foot family health centre.[8] A 10-story patient care tower will open in 2019,[9] adding 200 new beds.[10] The

hospital is one of several pilot projects being used to refine the "RELi resilience standard" for designing buildings, communities and neighbourhoods.[11] The U.S. Green Building Council, which was responsible for development of the widely recognized Leadership in Energy and Environmental Design (LEED) standard, is refining the RELi program to provide a prescriptive roadmap to guide architects, city planners, developers and governments to advance designs that are better adapted to projected climate changes, and capable of withstanding increased incidences of hurricanes, storms, drought, heatwaves and other types of disruptions.[12] The RELi standard also promotes climate change mitigation by incorporating elements of the LEED criteria related to energy and greenhouse gases (GHGs).[13]

The city of Corpus Christi, Texas is vulnerable to many of the impacts of climate change, which are expected to increase the costs, challenges and risks related to droughts, extreme heat and severe weather events.[14] Corpus Christi is particularly vulnerable to climate change-related increases in flooding and damage due to sea-level rise,[15] as well as an increase in the number and severity of hurricanes.[16] Innovative planning and design at Christus Spohn Hospital, which successfully withstood Hurricane Harvey in 2017[17] and is substantially reducing its building and operating emissions,[18] demonstrates that LCR can be mainstreamed into building design and operation.

Adaptation Design Elements

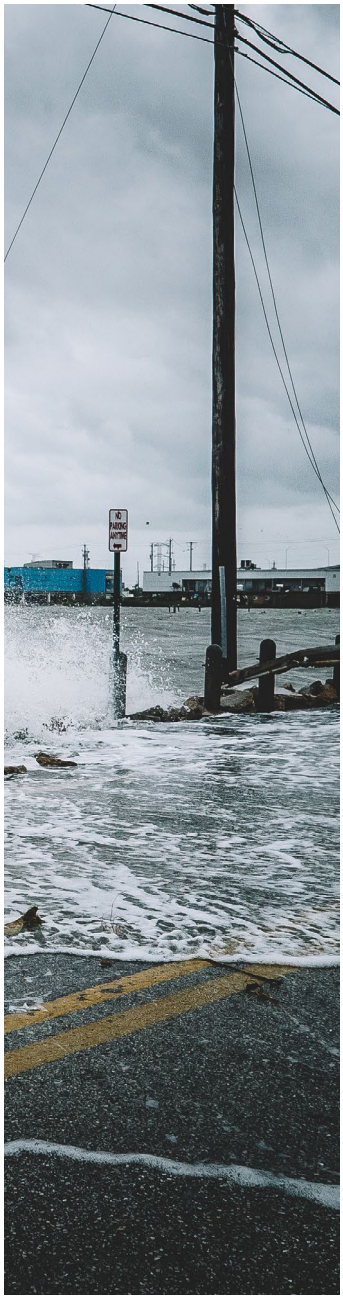
The RELi rating system takes a holistic approach to climate change resiliency, incorporating it into design, hazard reduction, materials and construction techniques,[19] thus ensuring that Christus Spohn Hospital is prepared for hazards and emergencies, such as loss of power or excess heat, that could compromise building function.[20] The structure has a hurricane-resistant exterior and oversized roof drains, rain gardens and green roofs to manage stormwater.[21] The hospital was placed in a 500-year floodplain, a substantially more cautious approach than the 100-year floodplain standard.[22] Reflective rooftops and strategic sun shading ensure that the facility is designed to stay cool even if the HVAC system is compromised.[23] In case of emergency, hospital protocol mandates maintenance of a four-day supply of food and water and generators that can provide power for five days.[24] The building features combined heat and power systems designed to improve efficiency during normal operations and continued operation during disasters.[25] During Hurricane Sandy, these types of systems were used to ensure that a number of public facilities, including hospitals, stayed operational.[26]

The hospital's designers recognize the building's potential to fulfil a unique function in the community, positioning it to operate as a regional command centre and refuge during natural disasters and other emergencies.[27] The project therefore goes beyond adapting a single building to the changing climate by contributing to resilience for the surrounding community.

Mitigation Design Elements

Although the RELi standard is principally focused on resilience, it also promotes climate mitigation by recognizing the energy and sustainability-related elements of LEED certification. The standard has minimum performance requirements in the "energy efficiency" and "atmospheric impacts" categories and awards credits for achieving energy optimization, carbon neutrality and net zero energy flows.[28] Christus Spohn Hospital has undertaken energy efficiency measures that will have a significant impact on its emissions. In 2017, the hospital was recognized for these initiatives,

"The building features combined heat and power systems designed to improve efficiency during normal operations and continued operation during disasters.



including its part in a switch to LED lighting expected to save half a million kilowatt-hours of electricity annually.[29]

Some elements of the building's design serve a dual role in increasing climate resilience and reducing emissions, such as its green roof and building cooling techniques. Green roofs reduce overall energy consumption by providing insulation and reducing demand for heating, cooling and stormwater management.[30] Green infrastructure has additional benefits for mitigation through its capacity to sequester carbon;[31] for instance, a single tree can capture several tons of carbon over its lifetime.[32]

"

Some elements of the building's design serve a dual role in increasing climate resilience and reducing emissions, such as its green roof and building cooling techniques.

LCR Co-benefits

The hospital's nature-based elements, like its green roofs and rain gardens, have benefits beyond their contributions to adaptation and mitigation. Naturalizing urban spaces provides habitat for pollinators and other species and contributes to the presence of nature corridors that are important for species mobility.[33] Human exposure to nature reduces stress, improves health and increases overall wellbeing.[34] Strategically integrating adaptation and mitigation can also be more cost-efficient; for instance, nature-based solutions tend to be cheaper to install, operate, maintain, and replace than traditional hard infrastructure approaches.[35]

Additional Opportunities for LCR Building Design

Other elements of building design and construction can also benefit from the application of LCR. Siting and location are essential components in reducing a building's vulnerability and energy requirements. Building siting (e.g., near transit stations), facilities (e.g., bike parking) and neighbourhood design (e.g., sidewalk width) facilitates user access via low carbon modes of transportation. The availability of multiple modes of transportation and robust transportation networks (e.g., street grids that provide multiple routes) can enhance efficiency of evacuation during emergencies. Shelter-in-place strategies that allow building users to remain on site during extreme weather events are especially important for vulnerable populations, reduce transportation-related GHG emissions, and even provide safety benefits by reducing the number of cars on the road. These design choices can have significant consequences; during Hurricane Rita in 2005, evacuations contributed to more than 100 deaths.[36]

The capacity to design buildings to actively adapt to changing conditions throughout their lifespan is emerging.[37] For instance, modular, prefabricated components can be reconfigured to suit changing conditions and demands on the building. Designing buildings to be more flexible may become an increasingly important component of ensuring they can adapt to a changing climate.[38] Increased flexibility can also minimize other environmental impacts, and benefit energy and resource-use efficiencies, by avoiding or delaying demolition and reconstruction.[39] "Long life, loose-fit" is a type of design approach that emphasizes using durable materials to ensure structures last while simultaneously maintaining flexibility in function and use of the building.[40]

Concluding Remarks

This case study demonstrates ways that LCR approaches are beginning to take shape in the public sector. Buildings currently being constructed and retrofitted will contribute to GHG emissions over their lifespans and will also need to withstand decades of climate changes. The LCR approach can help strategically address these challenges while providing multiple co-benefits.

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2.5.3. Municipal Climate Planning LCR Case Study: City of Hamburg

This case study provides an example of an LCR-based approach to local government climate action planning.

LOW CARBON RESILIENCE CASE STUDY: CITY OF HAMBURG CLIMATE PLAN

> Hamburg adopted a new Climate Plan in December 2015 ... and is pioneering an approach that interlinks climate change mitigation and adaptation as core strategies.

The City of Hamburg, Germany aims to become a "Climate Smart City" by 2050.[1] Hamburg adopted a new Climate Plan in December 2015, partly in response to the international Paris Agreement on climate change and is pioneering an approach that interlinks climate change mitigation and adaptation as core strategies. The Climate Plan is designed to be developed across departments and incorporates city districts and stakeholders. This case study demonstrates one city's incorporation of climate change adaptation and mitigation into its long-term vision through identification of targets for both climate action streams that it has incorporated into its development, economic, and communication strategies.

Background

Climate change is causing environmental, social, health, and economic problems for Canadians that are projected to intensify over the coming decades. Adaptation to climate impacts is essential because global temperatures have already risen and will continue to increase to some extent, even if we were to eliminate all GHG emissions today.[2] The success of global emissions reduction efforts (mitigation) will determine the severity of future climate impacts, which will continue to escalate if we do not reduce global emissions by around 80%, the goal of Canada's Mid-Century Strategy.[3] Low carbon resilience (LCR) is a lens designed to achieve strategic and systemic integration of climate change adaptation and mitigation, which have largely been planned separately to date.[4] Continuing to do so is inefficient in terms of resource expenditure and risks building in vulnerabilities, adding to emissions and missing transformative co-benefits. Integrating the two at all levels of policy, planning and practice via LCR approaches will help align climate action goals and advance the transition toward a more energy efficient, resilient, and sustainable future.

City of Hamburg Climate Plan

While Hamburg's original master plan featured climate change mitigation as a key component, it positioned adaptation as a future action item. The new Climate Plan expands the thematic scope of climate-related measures but calls for, and implements, a

long-term, transformational integrated mitigation/adaptation strategy, with mitigation and adaptation represented as interdisciplinary tasks which must increasingly become cross-sectoral components of urban policy at all levels.[6]

The plan includes guidelines for the development of "a smart city" that integrates conservation and sustainable development approaches, prioritizing green space, nature conservation and emissions reduction, and ensuring environmental goals are balanced with social and economic responsibility.

Hamburg has established a sequence of CO_2 emissions reduction targets that reduce emissions by two million tonnes between 2012 and 2020, with long-term targets to cut emissions to 50% below 1990 levels by 2030 and 80% below 1990 by 2050. This goal will be combined with Hamburg's target of achieving confidence that it is a resilient city that is adapted to climate change by 2050.

Hamburg has set itself the following targets:

Time axis	Climate change mitigation	Climate adaptation
2050	Climate friendly city At least 80% CO_2 reduction	Resilient to climate change, meaning a city adapted to climate change
2030	50% CO_2 reduction	Integrated action as a matter of course
2020	Hamburg makes a contribution to the national target: 40% CO_2 reduction	Climate adaptation kept constantly in mind (applies to government and civil society)

Figure 1 City of Hamburg (2015), p. 13

Four Action Clusters

Systematic changes needed to achieve Hamburg's Climate Smart City plan include recognition and support of a cross-sectoral approach plus development of synergies between individual action areas. The Coordination Centre for Climate Issues has been established to create the necessary operational structures with the participation of ministries, public enterprise and target groups from the private sector, and will report on joint routes to achieve the targets in the next update of the Hamburg Climate Plan. The City identifies four strategic clusters that illustrate ways partners can support one another and drive momentum:[7]

1. Transformation of urban spaces (city/neighbourhood development)

Hamburg can only become a climate-smart city if climate mitigation and adaptation are integrated into development. This integration will be concentrated at the neighbourhood level. By 2020, City planning departments, stakeholders and the housing sector will be mobilized to include mitigation and adaptation in planning. By 2050, Hamburg's transformation into a climate-adapted city will be well advanced.

2. Green economy

Hamburg's trade and industry sectors will contribute to the City's climate mitigation and adaptation targets as a component of social responsibility. Hamburg's business community and the Senate have committed to increase their efforts in the areas of resource

and energy efficiency, the use of renewable energy, and in their advisory capacity as well as training and qualifications.

3. The city as a role model

Hamburg's public sector will also contribute to the City's climate change objectives. For example, the Senate aims to achieve a comprehensive energy-efficiency renovation of public buildings by 2050.

4. Climate communication

As many municipal stakeholders as possible need to work on developing the Climate Smart City Hamburg, which the City hopes to establish as a brand, inspiring participation and value creation.

Green roofs

In addition to the four action clusters, the new plan contains 14 action areas, including urban development, human health, emergency management, buildings and mobility, and others. As part of the urban development action area, one of Hamburg's objectives is to green both the city and its roofs.[8] Hamburg is the first German city to have developed a comprehensive Green Roof Strategy, with the goal of planting 100 hectares of green roof surface in the metropolitan area in the next decade. The Hamburg Ministry for Environment and Energy is providing financial support for the creation of green roofs; building owners can receive subsidies covering up to 60% of installation costs for a total of €3 million by the end of 2019.[9] The City will make 20% of the green roofs on new buildings available to residents or employees for recreation in the form of sports fields and parks, or as gardens for shared use.[10] By promoting green roofs, the City aims to encourage space-efficient leisure areas, improve rainwater retention, increase biodiversity, and reduce extreme temperatures and urban heat islands as well as emissions.

Adaptation and mitigation benefits of green roofs:

- Temporary water retention, including during heavy rainfall events, alleviating flood risks
- Local cooling effect, resulting in lower energy consumption, costs and emissions
- Improved building insulation, resulting in lower energy consumption, costs and emissions
- Raised biotope and diversity of species

Co-benefits:

- Savings on rainwater retainment facilities on the ground
- Decentralised storage avoids costly damages and supplies pre-cleaned service water
- Lower long-term building maintenance costs due to increased durability of roofing and improved noise and heat insulation
- Absorption of dust and air-borne pollutants, resulting in reduced health care costs.[11]
- New space for recreation in densely populated city centre
- Competitive advantage for companies and landlords with green roofs

Hamburg combines promotion, dialogue, policy, and research in advancing its Green Roof Strategy,[12] which complements the city's sustainable rainwater management strategy, Rain InfraStructure Adaptation (RISA) 2030.[13]

Implementation of Hamburg's integrated climate strategy is a long-term goal based on interdepartmental and cross-sectoral transformation management. The city will rely on partners to achieve this such as the north German Federal States, the metropolitan area of Hamburg, industry (environmental partnerships/voluntary commitment by Hamburg industry), public enterprise, universities, schools, educational institutions, and other Hamburg stakeholders.

END NOTES

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3. CONTINUING PROFESSIONAL DEVELOPMENT

Continuing professional development (CPD) repeatedly emerged as a potential option for advancing low carbon resilience (LCR) practices during this project's engagement of professionals and professional associations.[1] However, there are currently far fewer training offerings for adaptation than mitigation, and none that advance LCR in practice. Given the imbalance in CPD climate action offerings, ACT worked with the Pacific Institute for Climate Solutions (PICS) to conduct a survey of British Columbia's professionals across sectors, regions and career stages that explored availability, content, and perspectives on needs for CPD for climate change adaptation.

Professionals and Continuing Professional Development on LCR

Continuing professional development was identified as an opportunity to advance LCR during initial consultations with professionals and professional associations. The following information was summarized in ACT's first report on this process (Section 9)[2]:

- Climate change tools and training exist for some professionals (e.g., CPA Canada, BC Energy Step Code, Municipal Natural Assets Initiative, Green Shores, Public Infrastructure Engineering Vulnerability Council (PIEVC)/IRP, etc.), but these focus on adaptation and mitigation separately
- Both national and provincial professional associations are involved in setting continuing professional development requirements
- No respondents had been required to complete CPD related to climate change
- Professional associations have different levels of comfort with the concept and application of climate change; not all have a shared understanding of the topic
- Collaboration with post-secondary institutions may be useful for climate action CPD development and delivery
- Cross-profession training and education could be used to develop the shared language around climate change required for collaboration.[3]

- Participants identified two key educational needs:
    - Profession-specific training
        - Clear role for professional associations through setting CPD requirements
    - Cross-cutting training
        - Funding sources unclear
        - Need to integrate learning across platforms

Consultation with Professionals on Climate Change Adaptation CPD

The purpose of this study was to assess the need for cross-professional training on climate change adaptation and make recommendations on the best way to address this need. This includes both how CPD should be designed and delivered, and guidelines for how to ensure it is effective and valued by professionals.

- The Auditor General of British Columbia found the provincial government is not doing enough to adapt to the risks posed by climate change.
    - The report recognizes the distinct role professionals play through the "professional reliance model"
    - Determined a need for continuing professional development programs on the impacts of climate change and how it will affect professional practices
- Professional associations in British Columbia typically have requirements or recommendations for their members to complete CPD
    - Engineers and Geoscientists BC and the Association of BC Forest Professionals are two notable associations that recommend, but do not require, CPD
    - The amount of CPD recommended or required varies greatly, from 12-80 hours a year
- A survey of CPD offerings related to climate change adaptation revealed that:
    - The majority (73%) of CPD offerings are sector-specific
    - Eighty percent are focused on a specific sub-topic
    - Only four offerings were non-sector specific, offering a broad view of adaptation
- CPD offerings related to climate change adaptation were largely ad hoc and infrequently rigorous. There is some comprehensive, sector-specific training available, but few substantial courses that are cross-cutting across professions
    - Professional development that provides a general foundation in climate change adaptation and is aimed at practitioners across disciplines would fill a niche that is neither available in British Columbia nor common across Canada or internationally

Survey Findings

The team interviewed a cross-section of 26 professionals in various areas of BC, including planners, architects, landscape architects, engineers, accountants, foresters and biologists at early, mid and late career stages, asking about general perspectives on CPD as well as experience of and interest in adaptation-related CPD.

- Professionals met their CPD requirements in a variety of ways:
    - Conferences, relevant reading, mentoring, webinars, teaching, serving on panels and committees, and conducting research
- Responses indicated that the value of cross-profession CPD would depend on the content, and that it is important to strike a balance between job-specific and multidisciplinary
- The majority (62%) indicated they felt a partnership between universities and professionals/professional associations is the best option to design and deliver adaptation CPD
- CPD that was considered well designed and delivered involved a mix of engaging speakers, lectures and case study work, and was delivered by professionals with relevant experience
- Eighty-three percent of respondents acknowledged that climate change adaptation is considered in their work to some degree, while 67% anticipated it being a component of future work; 40% expected requirements to consider adaptation to emerge in their profession
- Professions identified a wide variety of issues related to climate change that are emerging concerns in their professions, including:
    - Governance (political leadership, lack of regulations, costs to municipalities, etc.)
    - Physical hazards (extreme weather, floods, wildfires, drought, sea-level rise, etc.)
    - Profession-specific (water management, vector-borne disease, species die off, lack of data, etc.)
- Most (88%) indicated they saw value in a “multidisciplinary course that brings different professions together to learn about climate change adaptation” and the same number saw value in a certification/designation as a “trained adaptation professional”

Next Steps

The survey findings highlight the potential value of development of CPD related to climate change adaptation and reveal important lessons on how to make CPD useful for and attractive to professionals. ACT will apply these findings in the context of LCR by exploring development of CPD curricula and offerings that could be used in a variety of fields to build knowledge and capacity of professionals on LCR through future project deliverables.

END NOTES

1 Crawford, E. (2018). Professionals' Best Practices for Low Carbon Resilience. ACT, SFU: Vancouver, BC. Retrieved from http://act-adapt.org/professionals-best-practice-for-low-carbon-resilience/.

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4. LCR RESOURCE DATABASE

Professionals indicated that better access to relevant resources would improve their ability to understand and implement LCR approaches and expressed interest in a database that would allow them to access and share tools and data relevant to LCR across disciplines.[4] ACT is working to address this need by collecting relevant resources and planning development of a database.

Purpose: Provide professionals with a central hub to access information on LCR and guidance on useful resources, intended to be continually updated and expanded as new resources become available.

Description: The database will be hosted on ACT's website and provide a user-friendly interface for searching and accessing content related to integrating climate change adaptation and mitigation strategies. The primary method for interacting with the database will be based on the steps outlined in the LCR Conceptual Process Model (Section 2.2.1). Users will be able to access explanations and relevant resources for each step, turning the database into a flexible tool to guide users through aspects of LCR projects. Resources in the database will also be searchable by keywords and sortable by categories that will include the profession, industry or level of government to which they are relevant.

Content: The database will contain ACT's LCR-focused resources as well as content from other sources, including links to existing data and resource hubs. It will also include resources that can support integrated climate action strategies and will include brief descriptions of how resources are relevant to LCR. The database is intended to include the following types of resources:

- Tools – to assist in planning and operationalization of LCR
- Policies – to demonstrate how governments and organizations can mainstream LCR approaches and to aid knowledge transfer between jurisdictions
- Best practices – to provide information on emerging professional approaches to LCR strategies
- Case studies – to demonstrate the implementation of LCR in a variety of contexts

Audience: The database is intended for professionals interested in integrating emission reduction and climate adaptation strategies, and to support users at various levels of familiarity with climate change and integrated climate action approaches.

Progress: Currently, a variety of resources have been collected and organized according to suggested professions and appropriate stages in the integrated LCR process. Development of the online interface for the database is ongoing.

END NOTES

1 Crawford, E. (2018). Professionals' Best Practices for Low Carbon Resilience. ACT, SFU: Vancouver, BC. Retrieved from http://act-adapt.org/professionals-best-practice-for-low-carbon-resilience/.

5. FEEDBACK FROM PROFESSIONALS

a. National Professional Associations

Meeting Purpose: ACT collaborated with the Federation of Canadian Municipalities to co-host a meeting with representatives of Canada's national professional associations and organizations in October 2018 as a follow-up to our March 2018 meeting. The objectives of the meeting were to present the work ACT had completed over the summer, receive input and discuss strategies to encourage collaboration going forward. This section presents a high-level summary of key points from the discussion:

Overall responses: Where are we and where do we need to go?

- Climate change has created "wicked problems" and we can no longer rely on standard approaches. Things that used to be simple have become more complicated as reliable standards have become moving targets.
- Interdisciplinary action is a key response to this challenge – we need to more clearly make the case for this and make it easier to choose to invest time and resources in order to create buy-in, shared language, connections, and conditions for innovation.
- Some professions, for example, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, have begun to make explicit statements to the effect that we cannot rely on historical data for design parameters anymore and we need to consider climate change in future decisions.
- Every dollar we spend on adapting to climate change is less effective if we continue to emit greenhouse gases.
- There is an opportunity to be at the leading edge of a global conversation on integrating climate change mitigation and adaptation. Municipalities are great conveners and test beds for this type of collaboration, as they hire all kinds of professionals.

Feedback on Conceptual Model and Deliverables: Strategic integration of mitigation and adaptation:

- Integration offers multiple benefits because it can make actions more efficient and provide a good return on investment. However, it is not always possible or most beneficial to combine climate change mitigation and adaptation actions. Sometimes it is necessary to do an action that only accomplishes one of these objectives; however, as thinking through the connections between the two streams of climate action becomes business as usual, many synergies are beginning to appear. The point is that we need to consider both in any decision-making process and decide on the best course of action based on the results.

Mainstreaming integrated climate action into existing processes:

- We need to mainstream the integration of adaptation and mitigation everywhere possible and get people thinking about co-benefits, such as those inherent in land-use planning processes. The separation of adaptation and mitigation is artificial, and actions often don't fit neatly into one or the other. It often makes more sense to talk about the outcomes we want, such as low emissions and climate resilience.
- There is a need for both high-level and more specific guidance on how to integrate mitigation and adaptation. It is good to have a generalized process, but we also need to develop a more specific set of questions for people to think about, such as "Have you considered your proximity to a water body?"

Interdisciplinary collaboration:

- Bringing together separate teams on mitigation and adaptation needs to be built into the process from the beginning; doing this effectively can result in creative problem solving. There are different levels at which collaboration needs to occur – the project, association, training, broad policy/planning, and governance.
- Interdisciplinary training is an important component of bringing groups together. There is a need to build more capacity across disciplines as well as within them. Training should recognize there is a need to build interdisciplinary capacity and understanding, but also that each profession has unique issues that need to be addressed within the profession.

Joint Statement

In response to comments expressing a need for collaborative action on LCR, ACT drafted a joint statement for the national professional associations modeled on the statement developed by the BC PAAWG (Professional Associations Adaptation Working Group). The statement expresses commitment to both advancement of LCR and collaboration across professions to achieve this. Representatives of the professional associations responded

positively and identified the purpose of such a statement as being a way to emphasize to members that they have a responsibility to incorporate action on climate change into their work. Participants felt that there is now enough information on climate change that considering it should be part of the duty of care, and that there is potential liability in failing to meet that duty of care, especially as in the future, people may begin looking to recover costs if professionals have not adequately considered climate change in their decisions.

Once organizations have signed the joint statement, it will provide a lever to develop accountability and responsibility and build credibility for encouraging other associations to align with its intentions. It can also be used to make the case for LCR action with clients and decision-makers.

"Participants felt that there is now enough information on climate change that considering it should be part of the duty of care ...

Meeting participants also identified the following potential issues:

- Not all organizations involved in the meeting have the same structure; for example, not everyone is able to sign on behalf of their members, and for some groups, the provincial associations control the professional standards.
- It may be useful to have organizations that are signatories of the statement (professional associations) and other organizations that are supporters/endorsers of the statement (e.g., the Federation of Canadian Municipalities or the Canadian Water and Wastewater Association).
- The Federation of Law Societies of Canada and the Chartered Professional Accountants of Canada should be invited to sign the statement. Saving money and managing liability are two important factors in decision-making.
- The statement does not adequately communicate the urgency of acting on climate change adaptation and mitigation.
- The statement should include "calls to action" for senior levels of government that could provide tangible benefits almost immediately.

Future Collaboration

Participants were asked to identify the most productive ways to continue to collaborate, as ACT has some resources to continue to support this engagement. Responses included the following:

- The levers for and roadblocks for mainstreaming climate action may be different for different groups.
- It may be better for professional associations to meet with senior levels of government as one large group and have a common voice. This would provide an opportunity to put forward policy recommendations.
- Create clear objectives for working together, agree on what the problem is, and identify highest priority areas.
- It might be useful to pick a few areas to focus on and commit to some pilot projects/case studies. Ideally, associations can support these initiatives even when they are not leading. For example, green infrastructure involves planners, engineers, landscape architects, and municipalities and can be addressed through integrated asset management.

Next Steps

- Advance awareness of associations that have signed the joint statement and the actions they intend to pursue.
- Continue developing the conditions for success including involvement of other important organizations (e.g., CPA Canada and the Law Society).
- Start developing and prioritizing policy ideas that could be incorporated into an LCR policy briefing (e.g., carbon pricing or net-zero energy buildings) that all associations can advocate for or support.

b. BC Professional Associations Adaptation Working Group

Meeting Purpose: In collaboration with the Fraser Basin Council, ACT held a webinar with members of the BC Professional Associations Adaptation Working Group (PAAWG) in November 2018 as a follow-up to our 2018 March meeting. The event was used to discuss key deliverables from the LCR project and receive input on how ACT can continue to contribute resources for BC professionals and their associations going forward. This section presents a high-level summary of key points from the discussion.

Overall responses: Where are we and where do we need to go?

- Relevance/accessibility for those newer to climate change work:
    - Integration of adaptation and mitigation is interesting to people who work in climate change, but this approach/tools might seem daunting or

intimidating to people at the beginning of the process or not involved in climate change before.

    - There can be a disconnect between professions highly involved in climate change work and those who are starting to find it is part of their responsibilities. For example, highly engaged people understand the value of ecosystem services, but few municipalities really consider them.

- Mainstream into planning/implementation tools:
    - It would be useful if integration of adaptation and mitigation was supported by requirements to carry out this work. For example, stormwater management strategies need to be submitted with development applications. It would be ideal if municipalities also required climate adaptation strategies or responses as part of the application. ACT or PAAWG could provide a template to municipalities. We need to raise the bar of expectations but also provide quality control.
    - It would be useful if resources were developed that can help with prioritization, for example, a chart that ranks the most useful elements to include. It would be difficult to provide detailed results on a site-by-site basis but could be useful on a regional scale.
- Addressing and managing trade-offs:
    - With green infrastructure and ecosystem-based approaches (e.g., rain gardens and green roofs) there is concern they may increase costs and conflict with affordability goals. Often there are large community benefits (such as improved neighbourhoods or health), but because costs fall on the developers these initiatives are not undertaken.
    - It may be useful to prioritize retaining natural areas and their ecosystem services on sites, as many developments first take the site down to bare soil because it is easier to develop. It may be more cost effective to retain these functions than to try and put them back in afterwards.
    - Even with some good case study examples, it remains a challenge to get proactive and progressive LCR approaches implemented, even when they are cost-effective and ecologically useful.
    - Getting proactive and progressive LCR approaches that make good ecological sense and are good for the bottom line too seems to be an uphill battle.

Feedback on Conceptual Model and Deliverables:

- Profession-specific translation:
    - Two types of case studies would be useful: Those intended for a general audience to develop understanding of LCR, and others for professionals in particular sectors that provide more technical information.
    - It would be useful to have tools that go beyond a conceptual level and are specific to particular disciplines.
- Relevance at a smaller scale:
    - The tools/case studies presented seem more relevant to larger, more established/well-resourced communities or larger scale projects.

- It would be useful to have case studies that are smaller in scale and targeted at something individual practitioners could undertake, and/or demonstrate ways to contribute with smaller projects or in small communities. There will always be some level of support for leading pilot projects, but it is useful to support smaller initiatives that lack access to the same kind of resources.

Opportunities:

- Be strategic with LCR pilots and communicate the results far and wide in a number of media and summary approaches on all that was learned, including the "failures", incorrect assumptions, etc.
- The 2019 BC Land Summit may provide an opportunity to talk about cross-disciplinary action on LCR.
- BC Housing's Mobilizing Building Adaptation Resilience (MBAR) program may provide case studies of how energy efficiency and adaptation can be integrated in buildings.
- Outreach/communication:
  - Have professionals develop LCR presentations reflecting the needs, techniques, and opportunities in different professions.
  - Communication and relatable information are important.
  - Profession-specific periodic journals and magazines could be great vehicles for disseminating LCR concepts and materials, especially in terms of sector-specific and profession-specific application of the process steps.
  - Share the stories, recognize those communities who are illustrating leadership in climate resiliency – big and small – and celebrate the steps they are making.

c. ACTPAC

Meeting Purpose: ACT's Professional Advisory Council (ACTPAC) met in November 2018 as a follow-up to our March 2018 meeting to discuss findings from the project and explore ways LCR might be implemented in BC. ACTPAC member Angie Woo, of the Fraser Health Authority, gave a presentation on integrated climate action research and planning for BC hospitals as an example of an emerging LCR initiative. Participants engaged in a scenario exercise focusing on impacts relating to extreme heat in the year 2035, designed to explore challenges and opportunities for cross-disciplinary LCR action. This section presents a high-level summary of key points from the discussion:

> "In the municipal context, climate action should be part of a larger community planning process and applied at many scales.

Overall responses: Where are we and where do we need to go?

- Many professions are still only just beginning to become involved in climate change work and are not necessarily aware of the need to integrate adaptation and mitigation.
- It is important to recognize the cross-jurisdictional context, and the capacity as well as limitations, of local and provincial governments to achieve such goals and how much of the funding for them will come from local governments.

- Politicians and senior-level government administrators are important for influencing the adoption of LCR. Often, they work in siloed environments and rely on professionals, highlighting the importance of an increase in outreach to senior administrators to enable integrated climate action.
- It is often less challenging to secure funds to build a capital project than to maintain it; this may limit a focus on mitigation or adaptation benefits versus an integrated LCR approach.

Feedback on conceptual model:

- Applications of the model:
  - In the municipal context, climate action should be part of a larger community planning process and applied at many scales. Adaptation, mitigation and their potential integration through LCR are only one layer in a strategy that should reflect the community's vision; climate action should not be done in isolation, but should be integrated into all aspects of community, including asset management, emergency response, health and wellness planning and official community plan development.
  - This work should be connected to the Municipal Natural Assets Initiative, providing a deliberate connection to the value of, and strategic incorporation of, ecosystem services as community infrastructure and providing incentives for protecting ecosystem integrity and continued investment in this area.
- Process steps:
  - The first step, as is the case in all thoughtful project and planning processes, is the investment in engagement to enable ownership, and is key as this is where a range of professions could come together to collaborate, bringing forward their collective areas of knowledge and expertise.
  - The cross-evaluation process could happen sooner in the process to enable and encourage climate action integration from the outset.
- It is important to define timelines when using such models because it affects the emissions scenarios as well as potential return on investment; this is a key step for making the case to decision-makers.
- Defining minimum needs for mitigation and adaptation, and LCR, is key.

Feedback on Hospital Case Study

- Direct cost comparisons of projects that use LCR and those that do not would be useful.
- It would be useful to have a case study of a building retrofit project.
- It is important to consider the motivation for projects; for example, the LCR approach used at Christus Spohn Hospital was inspired by hurricane impacts, and the new Fraser Health Authority LCR project was driven by an internal champion.

Discussion on Fraser Health Authority Project

- It can be challenging to connect the dots between climate events and hospital use; for example, it can take days or weeks for heat stress to set in, so connecting heat waves to hospital use is complex.
- Green infrastructure initiatives, such as establishing urban tree canopy to contribute to cooling, can take decades (e.g., for trees to grow to a certain height), and must therefore be built in to high-level master plans.
- We need to mobilize doctors and nurses to communicate to patients and the public, as they are among the most trusted professionals. For example, they can convey information about how to prepare for disasters, or the correct facilities for accessing emergency services (e.g., these are often schools or community centres, rather than hospitals).
- Climate scenario exercises can resonate better than information about climate projections with senior leadership and frontline staff.
- The government needs to take the lead and provide a long-term vision, but these objectives need to be supported with resources. For example, the building code includes a brief assertion requiring the consideration of climate change but no specific guidance on how to do so.
- It is important to communicate solutions that have worked in other jurisdictions, while recognizing that various options will be region-specific.

Debrief of Scenario Exercise

- Challenges to cross-sectoral professional action on LCR:
    - Overlooking consideration of emissions reductions for those focused on adaptation and emergency preparedness, and vice versa, is common; however, participants indicated that there is a shared desire to build consideration of both adaptation and mitigation into processes from the outset.
    - There is a tendency to expect leadership to come from others and to not take responsibility to lead or champion as professional practitioners.
    - There is an overall lack of shared vision, goals, and objectives.
    - Political and/or policy changes and turnover pose challenges for sustained action and achievements in the long term.
    - There is a lack of enforcement and accountability in translating policy into tangible behaviour change.
    - Caution on missing voices in LCR discussions or processes – if they aren't there, essential issues and perspectives are not being considered.
    - There are challenges with missing information, data, and standards, as well as short-term thinking and bias.
    - Often the focus is on urban communities; there is often less attention paid to rural areas with fewer resources. It is important to consider the needs of, and engage with, small rural communities.

6. CONCLUSION AND NEXT STEPS

In a changing climate, it is increasingly urgent that all decisions and actions – from personal to professional and at all scales – include consideration of both adaptation to climate change and GHG emissions reduction.

Where appropriate, these two streams of action can be planned and implemented through an integrated approach, referred to in this report and elsewhere as low carbon resilience (LCR). At its highest level, LCR is a lens that can be used to embed adaptation and mitigation at all levels of governance, planning, research, and practice. Mainstreaming LCR approaches can enable resource efficiencies while driving transformative solutions for a variety of sectors, from transportation to urban planning to agricultural operations. Working to connect, align, and integrate the skills, tools, and funding currently used to advance adaptation and mitigation separately has the potential to drive more effective results using fewer resources than the current siloed approach.

Climate planning is subject to ongoing continuous improvement; many practitioners will be building from existing plans or strategies and incorporating LCR in an iterative fashion, and benefits can be gained by beginning to integrate these steps at any stage. This report illustrates how the two streams of climate action can be connected, and provides examples of how LCR might be mainstreamed into existing processes and tools, as well as examples of LCR in action at a variety of scales.

> “Practitioners across the professions have a key role as change agents in advancing LCR practices in all aspects of society.

Practitioners across the professions have a key role as change agents in advancing LCR practices in all aspects of society. During this project, professionals clearly indicated that they require case study examples of how LCR can be achieved, and concise, accessible information and tools that can be easily shared to build understanding and support for LCR. Professionals also repeatedly referenced the need for interdisciplinary forums, processes and resources that can help advance cross-sectoral, collaborative understanding and implementation of ways to achieve LCR.

ACT has received three years of support to continue this line of investigation with a specific focus on the municipal and community decision-making context. The findings from this first phase of work will be referred to and developed as the project continues, including through development of an LCR resource database and facilitation of interdisciplinary professional discussions and planning. ACT will also provide input into LCR pilot projects with BC health and higher education public sector organizations; develop policy analysis reflecting LCR thinking in the context of current governance needs and structures; contribute to content for LCR education and training offerings; seek to resource research into cost-benefit analyses for LCR projects; and produce and circulate accessible LCR communications and information for a variety of audiences.

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ACT (the Adaptation the Climate Change Team) at SFU brings leading experts from around the world together with industry, community, and government decision-makers to explore the risks posed by top-of-mind climate change issues and to identify opportunities for sustainable adaptation.

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