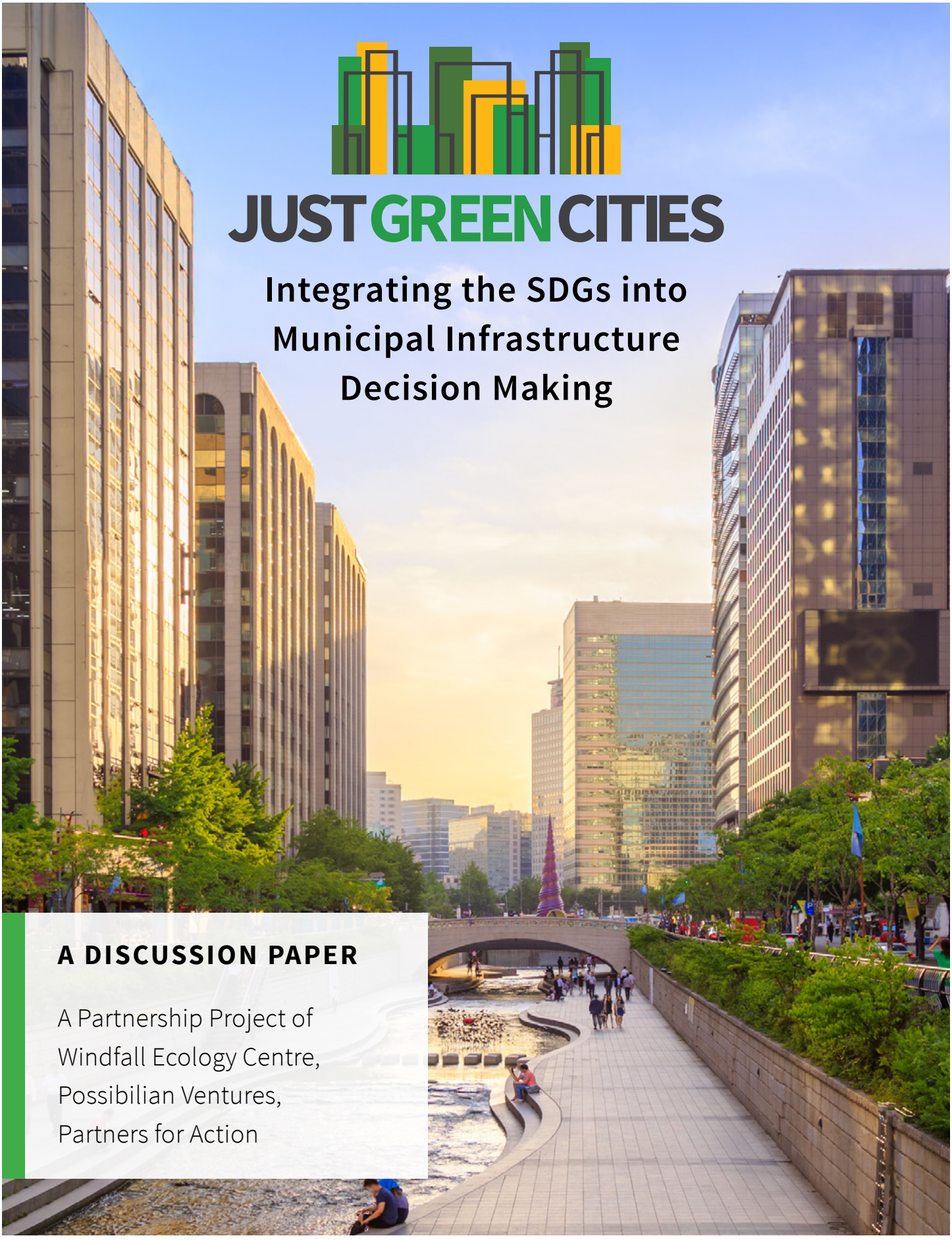

JUST GREEN CITIES

Integrating the SDGs into Municipal Infrastructure Decision Making

A DISCUSSION PAPER

A Partnership Project of
Windfall Ecology Centre,
Possibilian Ventures,
Partners for Action

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The opinions and interpretations in this publication are those of the author and do not necessarily reflect those of the Government of Canada.

Credits

Editor and project lead
Julie Wright, Partners for Action
Lead writer
Jacob Berkowitz, Quantum Writing
Researchers
Elvin Madamba, University of Waterloo
Reginald Oranye, University of Waterloo
Jonathan Serravalle, University of Waterloo

Reviewers
Joanna Eyquem
Ian Theaker
Shayna Rector Bleeker
Priya Bala-Miller
Nick Mocan
Atul Bhatt
Adam Vaiya

Rapporteur support
Elaina Cox, University of Waterloo

Project Partners
Possibilian Ventures
Michael Lewkowitz

Windfall Ecology Centre
Brent Kopperson
Lolade Odeyemi

Translation
Johanne Roberge

Report Design
QT Web Designs

March 2022

CONTRIBUTORS

The project partners deeply appreciate the contributions of workshop participants to this Discussion Paper. Participants included:

Emily Amon, Green Communities Canada

Steve Auger, Lake Simcoe Conservation Authority

Priya Bala-Miller, Palmyra Partners

Grayson Bass, Region of Waterloo

Atul Bhatt, Canadian Mortgage and Housing Corporation

Jerome Bilodeau, Environment and Climate Change Canada

Abbie Branchflower, Small Change Fund

Dustin Carey, Federation of Canadian Municipalities

Nation Cheong, United Way

Oscar Espinosa, Federation of Canadian Municipalities

Joanna Eyquem, Intact Centre

Nikolas Fehr, Environment and Climate Change Canada

Bissan Ghaddar, Ivey Business School, Western University

Michael Guadagnoli, Ecovert Sustainability Consultants

Heather Hannon, Lincoln Institute of Land Policy

Franz Hartmann, Small Change Fund

Nancy Hill, AECOM

Carla James, Nexial

Richard Joy, Urban Land Institute

Helen Kerr, KerrSmith Design

Kristopher Kolenc, REALPAC

Irene Lam, MaRS

Jacob Lamb, Transition Accelerator

Jim Lord, Ecovert Sustainability Consultants

Heather Mak, Diversity in Sustainability

Ana Maria Medina, City of Toronto

Nick Mocan, Crozier Consulting

Michelle Molnar, Municipal Natural Assets Initiative

Emily Nield, Epic Investment Services

Abhishek Raj, Canadian Urban Transit Research & Innovation Consortium

Shayna Rector Bleeker, Seven Generation Capital

Cameron Roberts, Transition Accelerator/ Carleton University

Becca Robinson, Reep Green Solutions

Alex Ryan, MaRS

Laura Schnurr, Tamarack Institute

Vanessa Schweizer, University of Waterloo

Cedric Smith, Pembina Institute

Irena Stankovic, Tricon Residential

Maxime St-Denis, Environment and Climate Change Canada

Kevin Stevens, Wilfrid Laurier University

Lindsay Telfer, Federation of Canadian Municipalities

Ian Theaker, Pembina Institute

Adam Vaiya, Peel Region

Patrick Welch, Lincoln Institute of Land Policy

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Introduction: From National Commitments to Local Action

This Discussion Paper addresses a core challenge Canadians face in implementing the United Nations Sustainable Development Goals (SDGs) and addressing the climate crisis: municipal infrastructure renewal. This is because about 80% of Canadians live in mid- to large cities, ones that must undergo massive transformation in order to reach our SDGs and climate goals by 2050. And municipalities have core policy influence over approximately half of all of Canada's greenhouse gas (GHG) emissions.

Here's the problem: The global SDGs and GHG frameworks to which Canada is signatory, the U.N. Sustainable Development Goals and the Paris Agreement, have created new GHG and social equity obligations. Yet, in Canada these frameworks are for the most part treated as aspirational. In practice the ambition they embody collides with a staggering lack of progress.

One key reason: the grand challenge of moving from big concepts to operationalizing change at the municipal level. So, as three organizations committed to helping Canada achieve the SDGs, we decided to help drive change by asking: How do we create a common framework and language for integrating equity-driven decision making into municipal infrastructure renewal to respond to the climate crisis and implement the SDGs?

We focused our research on three key areas of municipal infrastructure: net zero housing, fleet electrification and stormwater management. Notably, we also embed sustainable finance in our framing. In the lifetime of these three municipal infrastructure issues, sustainable finance and private capital will be major factors in driving—or stalling—change.

In order to create this evidence-based Discussion Paper, in the pandemic summer of 2021 we conducted literature reviews in each of the topic areas. These in-turn informed a series of topic-based scoping workshops with diverse participants from across Canada. We wanted to capture the most up-to-date experiences and voices of those working in these three infrastructure areas.

The resulting Discussion Paper provides two core tools: A unique, integrated landscape review on current municipal infrastructure renewal efforts; and a flexible framework for incorporating SDGs and equity-based perspectives into municipal decision making. We recognize that this Paper is a start—for example, Indigenous reconciliation and voices must critically be added to the conversation and partnership with Indigenous organizations is the appropriate pathway for that to happen.

We hope this Paper will fuel and expand efforts already underway in many Canadian communities to implement SDG-informed planning. The urgency of our situation cannot be overstated. During the course of this project, almost 600 Canadians died in B.C.'s summer heat wave followed by the most devastating and costly flooding in B.C. and Canada's history. These climate-related catastrophes emphasize how the municipal infrastructure decisions we make now will determine our well-being for generations.

We look forward to feedback and working with you to move from national commitments to local action!

Executive Summary: Just Green Cities

This Discussion Paper addresses a core challenge Canadians face in implementing the United Nations Sustainable Development Goals (SDGs) and addressing the climate crisis: municipal infrastructure renewal. In particular, how do we move from national commitments to operationalizing equity-driven change at the municipal level to meet 2030 and 2050 SDGs and greenhouse gas (GHG) reduction targets?

We focused our research on three key areas: net zero housing, fleet electrification and stormwater management. To create this evidence-based Discussion Paper, we conducted a series of topic-based literature reviews followed by foresight-informed scoping workshops with expert participants from across Canada. We asked participants to share knowledge and experiences of what they're seeing at the intersection of four key drivers of change: social equity; sustainable financial equity; the climate emergency; and municipal infrastructure. The result is a flexible framework for integrating these perspectives into municipal infrastructure decision making.

SCOPING CASE #1: EQUITY-DRIVEN NET ZERO HOUSING

In this case we explored the question of how we engage sustainable financial equity to achieve equitable, affordable net zero housing (NZH) projects. Buildings account for the majority of GHG emissions for many Canadian municipalities.

Of the three cases, we found that NZH is furthest along in the transition from visioning to concrete planning and implementation to meet SDGs and GHG goals. In the past two years, Toronto and Vancouver have developed either social equity and/or climate-driven NZH strategies and plans. It's also the infrastructure area with the greatest involvement of sustainable finance, ranging from private equity funds building low-carbon housing to major pension funds financing green buildings.

However, workshop participants noted significant NZH financing hurdles, including uncertainty around return-on-investment in a risk averse industry and a disjoint between the small size of proposed NZH projects and the larger opportunities sought by investors. Participants identified a set of basic tenets that should guide the equitable retrofit of rental properties and the need to build financing models that include co-benefits as an integral part of the business case.

SCOPING CASE #2: SUSTAINABLE AND EQUITABLE STORMWATER MANAGEMENT

Here we explored how to finance climate-change related adaptations to achieve sustainable municipal stormwater infrastructure using a social equity lens. Climate change-related flooding is the most immediate impact of the climate crisis for many Canadian municipalities. Yet investment in stormwater management (SWM) infrastructure suffers from a "great deferral"—it is the least-well maintained municipal infrastructure.

In Ontario, participants noted that municipalities, conservation authorities and industry associations have taken the lead, individually and collectively, in developing sustainable SWM approaches, including the use of natural asset solutions and green stormwater infrastructure.

Participants identified two key issues at the interface of social equity and SWM, using the rubric of who gets flooded and who pays to mitigate flooding? First, the majority of stormwater runoff in most Canadian municipalities comes from private properties, making it a public problem with private point sources. Second, how SWM is funded varies widely between municipalities, with some models much more equitable than others.

Workshop participants emphasized the need for issue framing and education of property owners, municipal officials and politicians to advance green SWM initiatives. In particular, emphasizing the massive flood risks and costs municipalities face if SWM adaptation measures are not taken.

SCOPING CASE #3: ECONOMICS AND SOCIAL EQUITY OF CANADIAN FLEET ELECTRIFICATION

Here we explored the role Canadian municipalities can play to accelerate a just transition to commercial and public e-fleets with zero-emission vehicles (ZEVs). Most of the impacts involved in fleet electrification are local, from air quality to charging infrastructure, and commercial fleets play a major role in local economies, notably in last-mile delivery.

We identified a significant trend towards the electrification of commercial vehicle fleets in Canada, and that municipalities are actively engaged in this transition. This includes the federal government's 2021 launch of the Zero-Emission Transit Fund (ZETF), a $2.75 billion program to support the electrification of municipal and private bus fleets. In 2021, Toronto-based delivery company Bolt Logistics announced it is building Canada's largest commercial ZEV fleet.

Workshop participants noted several financial hurdles to fleet electrification, including a lack of certainty around the resale market in an industry in which half of fleet vehicles are leased, and lack of financial data, for example ZEV residual values. Participants noted that municipalities have a key role to play in driving fleet electrification, including behavioural nudges, such as parking privileges for ZEVs. The scoping exercise identified the need for a wider range of voices at the table in discussions about fleet electrification, for example commercial drivers from immigrant and low-income communities.

Overall, our research reveals that there are an enormous number of SDG-informed emergent, creative solutions in the areas of municipal NZH, fleet electrification and stormwater management. What's also abundantly clear is that as an SDGs community we face a major challenge: engaging a broader range of equity-seeking communities in the SDGs-related municipal planning and decision making process.

The Context: From Here to 2050

This Discussion Paper is grounded in Canada's international commitments to both reduce greenhouse gas (GHG) emissions and social inequality, commitments which have recently been turned into high profile national policy.

In February 2021, the federal government announced *Canada's 2030 Agenda National Strategy*, a plan for implementing Canada's commitment as a signatory to the 2015 UN Sustainable Development Goals (SDGs). Among the 17 SDGs, the Strategy highlights the importance of climate action, equity-based advances and reconciliation with Indigenous peoples. In June 2021, the federal government passed the *Canadian Net-Zero Emissions Accountability Act*, Canada's route to meeting our national commitment as a signee of the Paris Agreement to achieve net zero GHG emissions by 2050. The Act pledges a 40-45% reduction in emissions below 2005 levels by 2030, achieving net zero emissions by 2050.

Thus, Canada has committed to achieving profound social and economic change within just eight to thirty years. What is also clear is that there is a huge gap in the specifics of how we will achieve these ambitious goals—and that much of this action must occur at the local level. To address this challenge, Windfall Ecology Centre, Partners for Action and Possibilian Ventures partnered (again) to create this evidence-based Discussion Paper to help guide and energize action to achieving the 2030 SDGs and 2050 GHG targets through municipal action.

INNOVATION IN INFRASTRUCTURE

We have entered a period when municipal infrastructure and maintenance decision making requires the kind of innovation usually associated with disruptive tech start-ups. This is because cities and their life-sustaining infrastructures are highly vulnerable to the impacts of climate change—from flooding to deadly heat waves. With climate change adaptation, maintenance is no longer sufficient and greater, forward-looking cooperation is required between all levels of government to achieve major equity-informed infrastructure renewal.

The incrementalism associated with infrastructure maintenance is no longer suitable in the age of climate change. In fact, maintenance as usual is a recipe for disaster.

WHY THESE THREE MUNICIPAL INFRASTRUCTURE CASES?

The three case studies chosen for this report—net zero housing, fleet electrification and stormwater management—represent key areas of challenge in aligning municipal infrastructure decision making with the SDGs. Housing and transportation are the two greatest sources of municipal GHG emissions and stormwater infrastructure is most municipalities' largest infrastructure asset, and liability.

The case studies share common core elements. Each case is complex, involving the intersection of diverse communities and varied built infrastructure, public and private interests, financial opportunities and barriers, the need for issue reframing, and a large potential for social equity impacts. Thus, the three cases, while outwardly very different, hold significant cross-over insights and lessons for policy makers. They provide a way to assess and develop responses to complex challenges using a common language framework.

THE PROCESS: SEEING THE PATH TO THE FUTURE WE SEEK

This Discussion Paper is the result of a process that was foresight-informed—we used the tools and techniques of futurists, adapted to our particular context. If we are going to imagine ways of achieving desired futures, we need to understand the current forces at play and identify any signs of change, and drivers that are creating this change.

Thus, this project began with University of Waterloo Masters students engaged to conduct a literature review in each of the three municipal infrastructure cases. The literature review benchmarked its topic in terms of current climate-related issues and Canadian (and some international) municipal actions, and the ways that social equity considerations and sustainable finance are, or could, play a role.

Each literature review in turn was the springboard to generate questions for three case-specific 90-minute virtual workshops, each involving ten-to-fifteen stakeholders from across Canada with a diverse range of expertise in private finance, social equity, policymaking, foresight, and subject matter experts, for example in stormwater management.

SIGNS TO THE FUTURE

Within each infrastructure area, the researchers and workshop participants were asked to identify three key elements used in foresight analysis:

- Signals of change: What are concrete signs that change is occuring in this area?
- Change Drivers: What are the key factors that are identified as driving the signs of change?
- Critical Uncertainties: Where are there identifiable gaps in knowledge that might significantly shape the future and impact policy decisions?

Taken together, each literature review and workshop was a scoping exercise—an effort to map the decision making space in each area. This Discussion Paper is reflective of the process we've undertaken. It's a product of discovering, reflecting, listening, inquiring, digesting, synthesizing, and critiquing. It's a synthesis of literature reviews and workshops, one that seeks to identify commonalities and put the three cases into a common framework.

WHAT'S A JUST TRANSITION?

According to the Climate Justice Alliance, an equitable, or just, transition for all three of these municipal infrastructure cases would be "a vision-led, unifying and place-based set of principles, processes, and practices that build economic and political power to shift from an extractive economy to a regenerative economy. This means approaching production and consumption cycles holistically and waste-free. The transition itself must be just and equitable; redressing past harms and creating new relationships of power for the future through reparations. If the process of transition is not just, the outcome will never be. Just Transition describes both where we are going and how we get there."

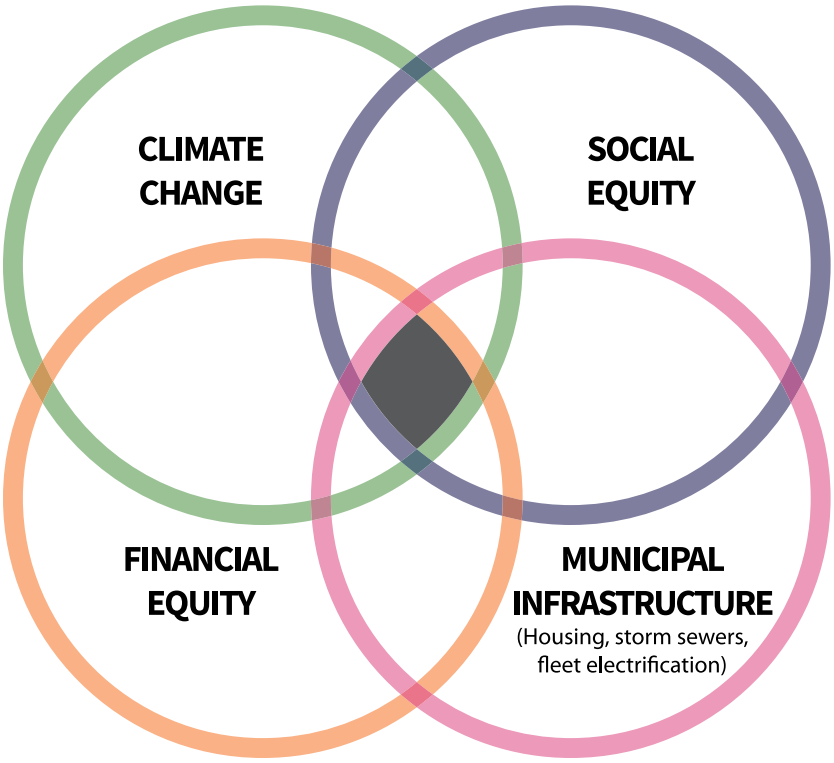
INTEGRATING SUSTAINABLE FINANCE

Sustainable finance is often deemed too emergent, or minor, a field to include in SDGs discussions. So, why include it here? Because we believe that *both* public and private finance, in the form of blended finance, must be primary levers in efforts to achieve our 2030/2050 SDGs and climate commitments. Public policy determines the critical government programs and public financing that underpin many of the SDGs. This public policy shapes investment market norms and goals, shifts mindsets, and creates market-based risk-reward incentives, for example de-risking new ventures. At the same time, another major pool of potential "green" capital is that held in pension funds, publicly-traded companies and "green"-oriented private equity. We cannot forget that pensioners, shareholders, and private equity owners have significant power, opportunity and responsibility to shift investment policies and priorities toward sustainable investing. And there are signs of movement in this direction, for example in Environmental, Social, and Governance (ESG) rubrics for pension fund investing and new organizations such as the new International Sustainability Standards Board. Private capital is essential for financing the wide range of envisioned SDGs-related projects—or acting as a barrier to their attainment.

A NOTE ABOUT QUOTES

The workshops that inform this Discussion Paper were convened under Chatham House Rule. This promotes free discussion among participants with the knowledge that all involved are free to use the information received, but not identity the speaker or their affiliation. Thus, the quotes herein are from workshop participants and are anonymous.

MAPPING THE EXPLORATION SPACE: AN EQUITY² FRAMEWORK



We explored what is changing at the intersection of four key drivers of change: social equity; sustainable financial equity; climate change; and municipal infrastructure. The combination of social and financial equity leads to an Equity² framework. The three case studies herein make clear that there are many gaps in embedding these four factors into integrated policy frameworks and identifying the overlapping sweet spot at the intersection of these four areas.

AN EQUITY² EXAMPLE: RENEWING THE TOWERS

The critical intersection of municipal infrastructure, climate change, social- and financial-equity is keenly exemplified by the now decades-long challenge of repairing and upgrading Toronto's "Tower-in-the-Park" buildings. These are residential towers of eight or more floors characterized by a concrete frame surrounded by significant open space. Currently, more than half-a-million Torontonians live in about 1,200 towers, all built before 1985 and with high GHG emission footprints. Of these, 801 are purpose-built rentals, the rest are condominiums, and 85% are privately owned.

Due to their poor condition, many of these buildings provide rental rates lower than those provided by newer rental buildings, resulting in "vertical poverty"—they provide housing for one-in-three low-income families in Toronto.

Now many of these buildings need major repairs and upgrades, and are at high-risk of failure. As a February 2020 report by the Urban Land Institute notes, "With a citywide vacancy rate of less than 1%, there is limited availability in the housing system and no contingency for widespread high-rise building failures."

SCOPING CASE #1:

Equity-Driven Net Zero Housing

Photo: Ryerson City Building Institute

The Goal

How do we engage ESG-driven financial equity to achieve equitable, affordable net zero housing (NZH) projects to mitigate the climate change emergency?

Context

For many Canadian municipalities buildings account for the majority of their GHG emissions. For example, according to the City of Toronto's new Net Zero Existing Buildings Strategy (2021) energy use in buildings accounts for about 55% of the city's GHG emissions. Approximately two-thirds of these buildings are residential, with equal contributions from multi-unit residential buildings and single family homes. Nationally, the operation of buildings, including heating and electrification of residential and commercial ones, accounts for about 12% of GHG emissions. This figure does not include these buildings' GHG emissions related to embodied carbon, i.e. the GHG emissions resulting from the manufacture and transportation of building materials.

Housing affordability and the climate crisis are shared issues across Canada. Thus, NZH initiatives, if coupled with GHG reductions, have the potential to be a triple-win: reducing GHG emissions; providing climate adaptation; and a tool for increasing social equity. This study and related workshop focused on the City of Toronto. Its large, diverse population, recent existing policies, and potential for urban development in the context of equity and climate change, makes it a useful candidate for a case study with national implications.

NET ZERO HOUSING DEFINED

A net zero house generates, from renewable sources, as much energy as it uses—so the net GHG production is zero. Notably, the use of "net zero" is complicated by the fact that it's sometimes used to refer only to a building's energy use, from all production sources, rather than being GHG net zero. NZHs cover the full range of home types and the definition can be extended to a portfolio of buildings and an entire net zero community.

> *"The development industry right now is fighting tooth and nail against one of the most basic equity opportunities going forward, inclusionary zoning. And it probably is going to come forward in some form or another, but, to the idea that there would be an easy market uptake on delivering both equity and net zero combined is a stretch. [It]is a big mountain when you put those two together."*

The Moment

This study found signs that in the past two years we have entered a new and critical period in the transition from visioning to concrete planning and implementation of NZH policies. These signs include:

- **In the past two years several of Canada's major municipalities, and many smaller ones, have developed either social equity and/or climate-driven NZH strategies and plans.** These municipal strategies and plans now moving to the implementation stage include:
  - The City of Toronto's Net Zero Existing Buildings Strategy was released in March, 2021. It builds on the results and modeling from the city's 2017 Transform TO: Climate Action for a Healthy, Equitable, Prosperous Toronto.
  - The City of Vancouver's Climate Emergency Action Plan approved in November 2020 commits to reducing the city's GHG emissions by 50% by 2030. A core part of this plan is Vancouver's Zero Emissions Buildings Plan which establishes specific targets and actions to achieve net zero in all new buildings by 2030.
- **For the first time there are significant NZH policy making tools and resources, and also equity-based NZH frameworks and scenario tools, including these studies:**
  - The Race to Zero Built Environment System Map tool was released in April, 2021. It is an interactive, online space for policy makers, businesses, investors, innovators and citizens to explore and visualize possibilities for transition to a net zero built environment.
  - The Carbon Risk Real Estate Monitor This online tool helps investors mitigate the transitional risk of real estate portfolios by evaluating the progress of a portfolio's carbon reduction performance in line with the Paris Agreement.
- **There are now several new national-level affordable housing initiatives.**
  - In 2020 the Government of Canada and the Federation of Canadian Municipalities created the Sustainable Affordable Housing (SAH) program. The $300 million program offers financial support to local affordable housing providers to retrofit existing affordable housing units, or construct energy efficient new builds that emit lower GHG emissions. The first SAH-funded feasibility studies for a variety of NZH projects were launched in May 2021.
  - The federal National Housing Strategy launched in 2020 is a ten-year, $70 billion, program with a strong social equity component that aims to invest in the construction of up to 160,000 new affordable homes.

NZH SIGNALS, DRIVERS AND UNCERTAINTIES

Workshop participants identified a range of signals of change, drivers and core uncertainties at play at the intersection of NZH, social equity and ESG-driven finance, as identified below.

SUSTAINABILITY LINKED FINANCING NZH SIGNALS

Emergence of "Green" Private Equity for NZH: In the past several years, private equity funds have emerged that are specifically focused on low-carbon housing. For example, Epic Investment Services, with offices in Toronto and Ottawa, created the One Planet Living Real Estate Fund which follows the One Planet Living bioregional principles.

Institutional investors seeking ESG projects: Large Canadian pension plans are looking to finance "green" buildings as part of their ESG strategies. For example, over the past several years the Canada Pension Plan's (CPP), investment specifically into green buildings has increased dramatically, according to its 2020 Report on Sustainable Investing. This includes contributing to the financing of the massive Barangaroo Development in Sydney, Australia which, according to the developer, when completed in about 2024, will be the first precinct of its size in the world to be climate positive and carbon neutral.

Rise in Green Bonds: In the past several years there has been a significant increase in the green bond market in Canada. Green Bonds are debt securities where the issue proceeds are used to fund projects with specific environmental benefits. For example, Ontario's Green Bond program is Canada's largest Canadian dollar-based green bond program with $10.25 billion outstanding. It is used to help finance public transit initiatives, extreme-weather resistant infrastructure, and energy efficiency and conservation projects. In December 2021, the federal government announced plans to launch an annual program of green bonds with an initial issuance of $5 billion.

> *"What I'm seeing in a case on the issuance of the green bonds is a huge rise in the last five years, with really interesting products and services coming through from the institutional investors side, but also on financials."*

New Green Finance Products: There are signs that new financial products are available for NZH development. For example, the Toronto Atmospheric Fund is a government-endowed non-profit agency that finances Greater Toronto and Hamilton-area initiatives to combat climate change and improve air quality. This includes Green Construction Loans "offered to developers who want to build energy-efficient projects without negatively affecting the market price." In Vancouver, Vancity Community Investment Bank offers Green Mortgages to finance energy efficiency retrofits.

Public-Private Alignment: Workshop participants noted that there is a close relationship between the policy certainty created by public investments and the entry of private capital. One sign of this is that in April, 2021, Scotiabank became the first of Canada's large banks to commit to supporting Canada Mortgage and Housing Corporation's program to transform housing affordability across the country by 2030.

> *"Some sort of public-private partnership seems essential [to meet NZH goals]."*

UNCERTAINTIES AND HURDLES IN NZH FINANCING

Scaling of financing requires project aggregation: Workshop participants noted that there's a disjoint between the size of green projects investors seek and the average scale of individual NZH retrofits and new builds. Investors are looking for relatively large, multi-million dollar projects; most current projects are much below this threshold. One proposed solution is to aggregate smaller projects, which could also serve to address risk in new ways and scale-up retrofits in existing building stock.

> *"One of the challenges is how do we create projects that are bankable? Creating a slew of buildings that may be aggregated, for instance, that meet investment criteria. Having these [types of] investments is one of the biggest challenges right now."*

ROI uncertainty: What's the math? Real estate development is a long term, low-margin business. According to participants, this makes it an industry that's highly risk and change averse. It's why some landlords put-off renovations—it's more profitable to garner rent income with a dilapidated, but functional building, than invest in repairing or upgrading it. In order for both investors and developers to embrace NZH it's necessary to clarify the economic model and explore alternative housing models so that a clear case can be made for innovation at scale. This must also include improved communication and education, such as the Canada Green Building Council's 2019 report Making the Case for Building to Zero Carbon. Additionally, Toronto Atmospheric Fund and Efficiency Capital have demonstrated that savings can be guaranteed by third parties in a delivery model that includes robust commissioning and ongoing operations and performance monitoring.

> *"There is a wall of capital that wants to flow into this, wants to do public good, is willing to accept a 3-4% rate of return. But the math and the mechanics don't line up."*

No business case in rental market: The uncertainty in NZH return-on-investment is particularly acute in the rental market, said participants. Mandatory disclosure of net zero performance ratings in real estate rental and sales advertising could be a significant point of leverage.

> *"For the rental housing market, particularly low-cost rental housing markets, there is no business case at this point."*

The diversity of the built housing market: Residential built infrastructure covers a wide range of types of buildings and ownership models. This ranges from tall tower condos and rentals, which are very different from three to four story wood-framed multis, which are very different from row housing, semi-detached, and detached housing. Participants noted that this diversity introduces a lot of complexity and uncertainty in terms of the needs, technologies, and costs associated with NZH retrofitting or building each type of structure.

HOW TO SPEND A BILLION ON NZHing?

"In speaking with a developer in Toronto, I brought them this challenge: Let's say, we have a billion dollars from [a bank], that is ready to flow into an application, the only condition is that whatever you build has to be sustainable and affordable. What do you need to make it happen? They said there isn't a straight forward answer. Can we even theoretically design a net zero building that is commercially viable? Or if not viable, what is the extent of subsidies necessary to make it attractive for governments to participate in that?"

> *"With regard to multifamilies in particular, we are already looking for financing for the actual construction of the deep retrofits which our teams are going to be designing. And we're also looking for the institutional financing to be able to do this. To solve this problem for the long term for the entire sector, that kind of scaling is not going to be easy."*

NZH vs. deep retrofits: There is a financing and economic gap between what can be termed traditional energy retrofits, supported by past home energy reduction subsidies, and the transition to NZHing. To get beyond a 15-20% reduction in building energy use for a building requires retrofitting the structure's envelope (air tightness, more insulation). This requires more knowledge, work and financing—something that the average homeowner is less likely to take on. Similarly, a participant noted that bigger commercial real estate players aren't committing to NZH by 2050 because they're attracted to the short-term gains from direct energy cost reduction, as opposed to all-out net zero to avoid, in part, the market uncertainties associated with financing NZH.

> *"The lower-performing buildings that can somehow be labeled "green", if they're only looking for 25% or 30% reductions in energy consumption, that often comes with a direct energy cost reduction that makes it financeable already. But if you start going beyond that, if you really are shooting for net zero, there's going to be serious need for financing, both of the retrofits and design and construction cost in of new buildings. As well as the institutional side of things to actually get people the information, the knowledge, and to erase the barriers and hurdles that have to happen to get there."*

Incoherent policies: Participants emphasized that there's a need for clear, long term, coherent and integrated policy commitments from all three levels of government to accelerate a transition to NZH.

> *"There is real confusion (for developers) around what doing the right thing looks like. The landscape of public policy is inconsistent. Or if it's consistent, it's not as clear to the practitioners. We're at a moment, right now, where we need to bring some coherency around why and how mainstream developers should embrace low-carbon."*

NZH-RELATED SOCIAL EQUITY SIGNALS, DRIVERS AND UNCERTAINTIES

A just transition to NZH: Participants noted that there could be significant unintended negative social equity and housing affordability issues related to the move to NZH. For example, the push to NZH could increase neighbourhood gentrification and thus social inequity, because it's often low-income renters who rely on old housing stock that would be impacted by the cost of NZ retrofitting. Participants emphasized that social equity must acknowledge the disproportionate impact of climate change on low-income and racialized communities.

> *"If it's not affordable, it will not be equitable."*

The equitable retrofit: Participants articulated a set of basic tenets that should guide the equitable retrofit of rental properties. These are:

- No increase in rent.
- A reduction in utility costs for electricity and heating.
- No displacement. Ideally, NZH retrofits should be planned and completed without displacing residents. When this is impossible, there is a need for "swing housing" to deal with major retrofits that require temporarily displacing tenants.
- Geared-to income grants: Grants capped at a maximum of $5000, with the owner paying most, will exclude many homeowners leading to greater inequality, not lesser.
- Need for significant information support. "The people who are the least equipped to be able to actually take some action with their homes to make them perform better in GHG or energy cost terms, are the people that need help the most."

FIRST OF ITS KIND EQUITABLE NZH RETROFIT

In August 2021, Natural Resources Canada announced a $547,500 investment to the Ottawa Community Housing Corporation (OCHC) to net zero retrofit affordable housing. The pilot project is the first of its kind in Canada to retrofit a four-unit townhome into NZHs while maintaining access to affordable housing. The renovations will be done without relocating tenants.

> *"The last thing we want to do is create a model of deep GHG retrofits that ends up putting people on the streets."*

> *"Going beyond net zero, the social aspect of ethical contracting is becoming more part of the supply chain discussion. In commercial real estate it's still fairly new, but I think contractors are going to have to be able to answer more questions from those who they're supplying to."*

Embodied carbon and operational emissions: In the discussion of social equity and GHG reductions, participants noted that it's important to consider both embodied carbon and operational emissions. Embodied carbon measures the GHGs produced in the creation of the building material, during construction and through end-of-life disposition, while operational emissions are from heating, cooling and electricity use by occupants. Participants noted that ethical contracting to address embodied carbon in the supply chain should also be a factor.

REFRAMING THE BUSINESS CASE

Some participants noted that in order to develop the business case for NZH we need to build financing models that include co-benefits as an integral part of the business case. Centering housing as a human right would help prioritize government investment in NZH that meets multiple social goals: job creation, emissions reductions, and greater resilience to climate change. Retrofit programs can have significant social benefit, such as the Mi'kmaw Home Energy Efficiency Project in Nova Scotia, which is both reducing energy costs, lowering GHG emissions and improving indoor air quality in as many as 2,400 band-owned homes in the 13 Mi'kmaq communities.

> *"The traditional business case [for NZH] in the way it's being approached so far, which is based on simple payback, is not going to allow us to go through this transition at the scale that we need to. [We need to integrate in] co-benefits, that includes a resilience to, for example, extreme heat, and extreme rain events."*

NZH POLICY TAKE AWAYS

Now is the time: As with Toronto's 2021 Net Zero Existing Building Strategy, we are at an inflection point between visioning and specific policy development and implementation. Governments at the municipal, provincial and federal levels are pushing NZH policies.

Policy tools for complex NZH transition planning: For the first time, there are now significant net zero housing policy making tools and resources and, to some extent, equity-based net zero housing frameworks (including this study).

NZH policy could have either major negative or positive impact on social equity issues: We are at a time when changes in housing design to net zero could have a major impact on social equity issues. Without social equity elements, NZH policies could increase rental and housing prices and also homelessness.

NZH policy must include social equity considerations from the very start in order to achieve social equity goals: Deep retrofits add to the cost of much needed affordable housing which has implications for the full cost of shelter. However, retrofits can also contribute to the alleviation of energy poverty which is measured in Canada as the home-energy cost burden. Public policy and finance are required to address the provision of clean, affordable and quality energy services in affordable housing.

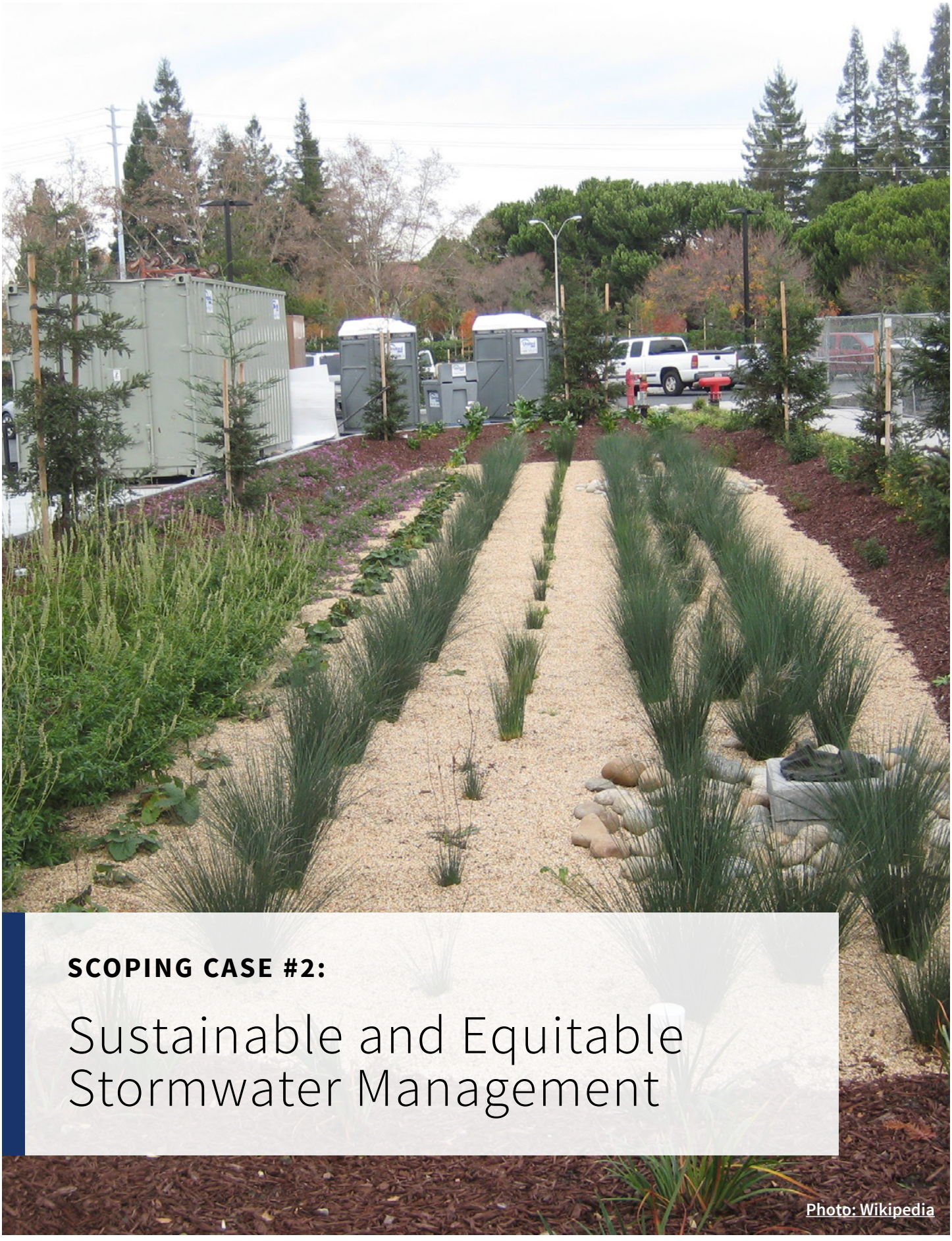
Need to reframe the business case for NZH: Participants noted that we need to include co-benefits as an integral part of the business case, as it needs to be approached now, if we are serious about getting to a net zero over the next 30 years.

Position net zero as desirable for consumers and not just a moral imperative: Education and clear, benefits-oriented communication could help to create market demand.

Need for policy coherence across levels of government: Participants identified the need for clear signals, policy integration and coherence across levels of government.

Policy sticks and carrots: As well as offering financial and other incentives to drive an equity-based NZH market, participants noted that governments must also use regulations and laws to meet public policy targets.

"[Governments need to use] sticks and not just carrots. I think there needs to be calls for much stronger, more coordinated government public policy and government involvement in achieving these objectives. I think anything going forward needs to start signaling that."



SCOPING CASE #2:

Sustainable and Equitable Stormwater Management

Photo: Wikipedia

The Goal

How to finance climate-change related adaptations to achieve sustainable municipal stormwater infrastructure using a social equity lens which considers two key questions: who gets flooded and who pays to mitigate flooding?

Context

Climate change-related flooding is the most immediate impact of the climate crisis for many Canadian municipalities and the number one threat for municipal water systems. It's also one for which municipalities have direct responsibility through stormwater management (SWM) and municipal natural asset planning. Yet stormwater infrastructure is the least-well maintained infrastructure in most municipalities. This has created a SWM infrastructure perfect storm: an increase in extreme rainfall events is meeting a historic juncture in the need for stormwater infrastructure renewal.

Multiple single day rainfall records were set in Canada in 2021, highlighting inadequate stormwater infrastructure and management. For example, on September 22, 2021 southwest Ontario had the heaviest rainfall in recorded history. Middlesex County, which includes the City of London, declared a state of emergency due to flooding. Renewal of what we already have won't be enough. We need both grey and green infrastructure to accommodate the flow of water instead of trying to control it, which is a reframing of our traditional approach.

A BURRIED ASSET - AND ISSUE

Stormwater infrastructure is often a municipality's largest infrastructure asset—and liability. For example, the municipality of Mississauga owns $4.5 billion worth of stormwater assets as compared to $2.9 billion in roads. Yet, in part because stormwater assets are literally a buried issue, municipalities have delayed maintenance and upgrading to stormwater systems. This has produced an estimated present day $6.8 billion stormwater infrastructure deficit in Ontario.

> *"Of all municipal infrastructure, stormwater has probably been the least well-funded. We just keep kicking the can down the road, because you can get away with it. Climate change is going to rear its ugly head and bite us for that."*

The Moment

In Ontario, a lack of updates to SWM policy: There has been no official update to Ontario's provincial guidelines for SWM for nearly two decades. In 2017, the Ontario Ministry of the Environment and Climate Change sought public input on a proposed Low impact development stormwater management guidance manual, recognizing an emerging critical challenge for municipalities. However, as of early 2022 this policy document remains in limbo.

Emerging green infrastructure regulation, policy guides and best practices: In the absence of provincial leadership, workshop participants noted that several municipalities, conservation authorities and industry associations have taken the lead in developing green SWM approaches. In 2009, Toronto was the first city in North America to adopt a bylaw to require and govern the construction of green roofs. The Green Roof Bylaw sets out a graduated green roof requirement for new development or additions that are greater than 2,000 m^2 in total floor area. This initiative energized the Green Roofs for Healthy Cities industry association, which in 2019 published a Green Roofs for Healthy Cities Policy Guide. In 2010, the Toronto and Region Conservation Authority, Credit Valley Conservation, and Lake Simcoe Region Conservation Authority (in consultation with federal, provincial, municipal and industry stakeholders) developed the Low Impact Development Stormwater Management Planning and Design Guide. It remains one of the most comprehensive guidance documents of its kind in Canada.

GREEN STORMWATER INFRASTRUCTURE AND NATURAL ASSETS

Historically, municipalities have achieved SWM primarily using grey infrastructure—i.e. concrete to build structures such as stormwater ponds and extensive storm sewer networks. However, given the cost of grey infrastructure and need for sustainable alternatives, there is increasing use of natural asset solutions and green stormwater infrastructure, also called Low Impact Development (LID). Green infrastructure minimizes flooding and protects water quality by harnessing natural processes to capture, store, and filter water close to where the rain falls, and in other cases, slow or reduce the upstream runoff in flood vulnerable areas. Natural assets such as aquifers, forests, streams, and riparian areas can provide municipalities with vital services equivalent to those from many engineered assets. Other natural techniques, on both private and public lands, include vegetated rooftops, roadside plantings, absorbent gardens, rain barrels and permeable pavements. Notably, green stormwater infrastructure and protection of natural assets does much more than just reduce flooding—it transforms cities into more liveable, resilient, and sustainable green spaces.

There is a growing body of evidence-based research, data and networked communication to support green SWM: The Sustainable Technologies Evaluation Program (STEP) is leading a number of ongoing pilot projects in the Toronto area evaluating and demonstrating the technical and financial feasibility of green SWM infrastructure on private and public lands. Similarly, in October, 2019 the Canadian Federation of Municipalities and partners published the first Canadian municipal case studies focused on climate change-related infrastructure issues. Finally, the Green Infrastructure Ontario Coalition is providing a network for the sharing of research, data and best practices among non-profits and municipalities.

New equitable approaches to flood risk management at watershed-scale on both private and public lands: The year 2021 marked the publication of the first two Canadian research projects aimed at improving green SWM to reduce both flooding and social inequity. The "Equitable Responsibility for Transformative Design: A systems-based approach to watershed management" report demonstrated that improved environmental outcomes can be achieved at lower costs if SWM is planned at a watershed-scale and considers the use of both publicly and privately owned lands. A University of Waterloo study is the first to improve municipal flood risk assessment by mapping socioeconomic vulnerability. The report notes that urban flood risk is the product of three interacting variables: the flood hazard, the exposure of people and assets, and the vulnerability of people and assets to flood impacts. The study notes that most Canadian studies on the topic "fail to include socioeconomic vulnerability".

Tools for return-on-investment calculations, as well as inventory and valuation of natural assets: In 2021, the Credit Valley Conservation Authority and the Peel Climate Change Partnership released one of Canada's first Risk and Return on Investment Tool (RROIT) to help municipal staff and politicians make evidence-based, cost-effective decisions to reduce flood and erosion risks. MNAI inventory projects are underway in British Columbia, Ontario, Northern Canada and Atlantic Canada with more than 90 communities engaged.

An appetite for individual landowner action: Workshop participants said that since extreme-weather-related flooding is becoming a top-of-mind issue for Canadians, individuals are looking for the opportunity to participate in solutions.

"Flooding and stormwater is one of the most immediate impacts of climate change we will feel. What we've found is that when faced with climate change and the climate crisis, direct action breeds hope. And so people want to know, what can I do to make a tangible difference? So I feel a cultural shift starting to happen around how to manage the terrain."

SWM SIGNALS, DRIVERS AND UNCERTAINTIES

Workshop participants identified a range of signals of change, drivers and core uncertainties at play at the intersection of SWM, social equity, and finance, as identified below, by category.

SUSTAINABLE SWM PUBLIC FINANCING

New requirements for ON SWM asset management: Workshop participants emphasized that SWM infrastructure suffers from what can be called the great deferral—putting off public investment in critical infrastructure. In Ontario, the extent of this deferral has been made clear by the province's 2018 *Asset Management Planning for Municipal Infrastructure Regulation*. enacted because "in many parts of Ontario, existing infrastructure is degrading faster than it is being repaired or replaced, putting services at risk." The regulation requires municipalities to make an infrastructure asset inventory by 2024. Workshop participants noted that the lack of prior investment means that there's now opportunity for implementing LID SWM solutions. Some funding models, such as green bonds, require strong governance, financial controls and reporting standards in order to meet the criteria of a science-based environmental performance framework as described in a March 2021 report from the Center for American Progress.

SWM GOES TO COURT IN OAKVILLE, ON

Climate-change related increases in the designated size of flood hazard zones is creating legal issues between property owners and municipalities. The most prominent case is in Oakville, ON, where in 2020 homeowners filed a $1 billion class action suit against the municipality after updates to flood risk maps placed their homes in flood hazard zones. "These types of lawsuits, especially class actions related to flooding in communities, will become more widespread. [People are] looking to governments, who have big deep pockets, to help them recover from damages," said Laura Zizzo, who in 2020 co-founded Manifest Climate, a Toronto-based consultancy.

> *"One of the great things that the province of Ontario did was a mandated asset management plans for municipalities. And so for the first time, municipalities are aware of the stormwater infrastructure, natural and engineered that they have."*

A public problem, with private point sources and opportunities to incentivize mitigation:
The majority of stormwater runoff in most Canadian municipalities comes from private properties. Participants noted that this means that municipalities must engage with private landowners in developing LID SWM solutions. For example, the City of Waterloo offers up to 45% off the stormwater fee for SWM on private property. Similarly, in 2021 the City of Ottawa piloted *Rain Ready Ottawa*, offering up to $5000 in rebates to encourage residents to implement LID approaches to SWM on their properties.

> *"I've looked at dozens of municipalities across Canada. And in every single one of them, the majority of the stormwater runoff comes from private property. How much of it, whether it's 60% or 80%, will depend on the form of developments, whether it's a downtown core versus low rise, semi urban."*

> *"There's an argument to be made that focusing natural infrastructure on private properties is actually an effective way of reducing stormwater runoff."*

Diversity of SWM services fee structures raise equity issues: About 20 Canadian municipalities charge a specific SWM user fee, also known as a stormwater utility. (For comparison, more than 1500 communities in the United States charge such fees.) The revenue is ostensibly used to provide the municipality with a dedicated source of SWM funding. Workshop participants highlighted that there are a wide variety of ways that Canadian municipalities structure these fees: no stormwater utility (Toronto); urban vs. rural rates (Ottawa); stormwater utility applied to all residents (Mississauga, Guelph, Calgary); and stormwater utilities calculated on specific criteria, such as the runoff coefficient, impervious area measurements, and property size.

> *"A lot of the stormwater fees and the nuances and differences between them are politically based."*

> *"People who are not paying a separate stormwater tax are still paying for it, it's just being presented differently—lumped into general taxes. So I think we should not forget that we're still paying for stormwater to be treated, it's just that the people are not paying in a way that incentivizes them to reduce runoff."*

Calculating the SWM ROI—data needed: Workshop participants said there's both a need for better SWM and related utility data, and also better modeling to incorporate co-benefits into calculating return-on-investment (ROI) for LID SWM initiatives. For example, green SWM infrastructure (green roofs, permeable surfaces) also reduce extreme heating events and improve water quality. This would enable municipal decision makers to see how SWM initiatives help them meet a range of longer term goals.

"You need the numbers because at some point, the policy makers, the politicians are going to say, 'Show us the data that this is going to work.' So we have to have that data there as well."

"We provide stormwater management designs for all developments from commercial, industrial to residential. I wish I had better data that could help me build a case to say, you'll get this rebate, but you're also going to get a 10, 15, 20-year return on this investment. That data, that information would help me even sell (LID) to my developer clients."

Education and issue framing: LID SWM professionals in the workshop emphasized the central need for education and issue framing to advance the adaptation of green infrastructure initiatives. The target audiences include both property owners and municipal officials and politicians.

"We need to create a new frame for discussing natural infrastructure and stormwater fees, that it no longer reinforces or allows our opponents to frame this as a new fee or tax (such as a 'rain tax'). It's really vital to create a narrative for [private homeowners] that gets them to start seeing natural infrastructure as a way of increasing property values"

"When I say public education, the biggest [public] is probably [municipal] Council. One of the biggest focuses now is on educating Council on SWM needs and that has resulted in huge benefits in terms of acceptance of these new stormwater fees."

Cross jurisdictional SWM solutions: In developing sustainable SWM approaches, workshop participants emphasized that it's crucial to plan at watershed scale and include flood management strategies upstream of the area that is most flood vulnerable. For example, participants referred to the watershed-scale approach of the 2020 Lake Simcoe Region Conservation Authority's Watershed Development Guidelines.

"In many communities where we do complete modeling and scenario analysis to look at the capacity of natural infrastructure to manage stormwater we find it's not just where impermeable surfaces are, it can also be the neighborhood upstream from you, or the municipality upstream. So, watershed scale is incredibly important when you're considering stormwater."

The cost of severe storms and inadequate SWM: Workshop participants noted that there will be increasing pressure from insurers, homeowners and others for municipalities to address severe rainfall-related infrastructure issues. The July 8 2013 torrential rainfall and resulting flood in Toronto resulted in $1 billion in insurance claims.

Quality not just quantity: *"So when we're looking at fees, I think that looking at the water quantity is important, but the quality is equally important and understanding what LIDs may be best suited to removing things like metals or salts or phosphorus, each aspect of quality will have a solution."*

SOCIAL EQUITY SIGNALS AND DRIVERS

Need for a new equity lens on SWM: Workshop participants noted that historically, social equity has not been considered, or has been a very minor issue in SWM. Certain populations are disproportionately vulnerable to flood risk due to a combination of social depravations and have little control over legacy infrastructure factors contributing to their physical risk—like the climate resiliency of housing stock, where affordable housing is located and the lack of permeable surfaces in their local environment.

Unequal socioeconomic impacts of flooding: As the climate changes with increasing weather extremes and precipitation resulting in massive stormwater runoff, there is the tendency for vulnerable communities to experience much greater climate impacts, thereby exacerbating inequalities. An important consideration is that while fluvial (river) flooding tends to affect people with more financial means to recover, pluvial (extreme rain) flooding tends to affect people with the highest level of social and economic instability.

Equitable stormwater fees: The design of stormwater utilities, which currently varies widely among municipalities, can have a major impact on marginalized and vulnerable populations, either increasing or decreasing social equity.

SWM FEES: WHO PAYS IN PEEL REGION?

Peel Region, ON, is a clear example of the way a municipality chooses to fund the cost of SWM infrastructure renewal has a significant impact on social equity. In Peel the majority of infrastructure renewal is funded through the water utility rate. This disproportionately shifts the SWM burden to poorer residents. This is because the utility rate is a regressive charge—every user pays the same, regardless of their income or wealth, while the property tax is progressive—the more valuable a property the higher the property tax. Moreover, property tax increases (a political hot button) are generally kept at around 1% a year, while in Peel the water utility rate has more than doubled over the past decade. This dynamic will accelerate over the next decade as the municipality replaces billions of dollars of aging water and wastewater pipes, and other infrastructure.

> *"Wealthy property owners were effectively subsidized by those who rent and have to pay utility costs, including some of the most vulnerable residents in Peel."*
>
> Journalist Isaac Callan, The Pointer

Gentrification effect of green infrastructure: In municipalities, lower-income neighbourhoods are often those with the highest percentage of impermeable surfaces and least green infrastructure. Thus they are places that would be benefit the most from green infrastructure renewal. However, participants cautioned that this renewal itself could displace residents through gentrification.

> *"When you add green infrastructure it actually adds to property values. And then the people formerly in those areas, maybe can't afford to be there. So I think the equity consideration for green infrastructure is how do we keep things affordable while adding green infrastructure?"*

Participatory planning: Noting that SWM policy discussions have historically not included equity considerations, participants emphasized that it's vital that vulnerable groups and communities are incorporated into the design and implementation of green SWM infrastructure. This will require new outreach initiatives and ways to engage previously excluded communities. This is a leading edge of participatory planning, with some of the first steps in this direction including the 2019 research paper: *Fostering sustainable communities through community engagement; a template for community engaged green stormwater infrastructure planning.*

> *"An equity-based way [to develop green infrastructure] is through participatory planning within the communities to ensure that community place-making is taking place within the realm of the green infrastructure that's being implemented. So we're actually doing multiple things at once. We're reducing flooding and reducing heat island effect, but also creating better access to local green spaces, improving health outcomes, and improving community safety."*

POLICY TAKE AWAYS

Municipalities face massive flood risks and costs over the next decade: Extreme rainfall and flooding events represent a massive financial risk—much of which will be borne by homeowners, businesses and governments. If adaptation measures are not taken, by 2030 the annual cost of flooding in Canada is anticipated to nearly triple to US$6.6 billion.

With increasing severe weather events and stormwater issues, related SWM fees (utilities) will become an increasingly important issue in municipal politics.

Municipalities must consider both new LID stormwater regulations and enforcement in order to create change.

"I don't yet know of a case where [a rebate alone] convinced someone who had no interest in green infrastructure to implement it. I have only seen significant green infrastructure implementation when there is an environmentally conscious developer or where there are regulatory requirements, i.e. 'you have to do it.'"

"Even in those [communities that have] LID stormwater requirements, there's no staff to enforce them."

Need to integrate and embed equity-based SWM into planning process and include the value of natural assets on financial statements.

"The next journey is how do we not just find the opportunistic project, but really start to bring this into the planning conversations."

To succeed with green SWM policies, municipalities need to develop solid communication plans: Increased awareness among the public, policy makers and politicians is vital to driving the uptake of green infrastructure in Ontario.

"What we really need is a major public relations and communications exercise to talk about the benefits of natural infrastructure. Because if you can create positive feeling towards natural infrastructure, then it's a lot easier for public policy makers to adopt policies that support it."

Mixing grey and green: The stormwater management solutions of the future will be holistic systems that integrate both grey and green infrastructure to protect communities and the natural environment. We can also expect climate change to be a major driver of innovation in SWM.

Municipalities must work collectively at watershed scale in order to develop effective LID SWM policies and regulation.

City planners and policy-makers can contribute to equitable implementation of Canada's 2030 SDG and 2050 climate change targets by:

- Using scenario planning and sustainable financing measures to develop equity-based green infrastructure and stormwater utility fees across watersheds;
- Incorporating sustainable stormwater practices into government policies on planning and natural resources;
- Using fiscal incentives and other supporting policies such as zoning to promote the creation of green SWM infrastructure by private landowners.

SCOPING CASE #3:

Economics and Social Equity of Canadian Fleet Electrification

The Goal

What roles can Canadian municipalities play to accelerate a just transition to public and commercial fleet-based zero-emission vehicles (ZEVs) to reduce GHG emissions?

Context

Municipalities are where the proverbial rubber meets the road in the transition to commercial and public fleet electrification. This is because most of the impacts and changes involved in fleet electrification are local. These include local air quality, road maintenance, charging infrastructure, traffic control, parking, building codes and land use policy. Also, commercial fleets play a major and increasing role in local economies, notably in e-commerce and last-mile delivery.

In 2019, the transport sector accounted for about a third of municipal GHG emissions and was the second largest source of national GHG emissions, accounting for a quarter of total emissions. Notably, the transport sector has had the most rapid increase in emissions—between 1990 and 2019, transport sector GHG emissions grew by 54%, mostly driven by increases from freight trucks and light trucks, vehicles which form a large part of Canada's commercial fleets. It's notable that medium and heavy duty trucks, which make-up just 3% of the vehicle stock, account for 40% of Canada's transportation-related GHG emissions, thus the electrification of these vehicles holds enormous potential to reduce GHG emissions.

WHAT IS COMMERCIAL FLEET ELECTRIFICATION?

Commercial fleets are work vehicles owned or leased by a business. Canada's fleet market is diverse, and varies by region and commercial sector. Most commercial fleets are in the service sector, from last-mile delivery to construction (Ontario/Quebec) and energy (Western provinces). A fleet can range in size from two to hundreds of vehicles, with the average Canadian commercial fleet size estimated at between 35-70 vehicles. These vehicles include cars, pick-up trucks (primarily construction), vans, cube vans, buses and heavy equipment. About 55-60% of the commercial fleet vehicles are owned, the remainder leased. With concerns about GHG emissions and fossil fuel costs, some businesses are transitioning the whole or part of their fleets to electric vehicles. These range from plug-in hybrid vehicles to fully zero-emission vehicles (ZEVs), including battery electric vehicles and hydrogen fuel cell electric vehicles.

The Moment

This scoping exercise identified a variety of signals and changes that point to a significant trend towards the electrification of commercial vehicle fleets in Canada. Within this trend there are a number of signs that Canadian municipalities are actively engaged in this transition, both as fleet owners and in relation to local commercial fleets.

A turning-point in Canadian federal government funding for ZEV municipal and commercial bus fleet infrastructure: In the past year, the federal government initiated a program that could greatly accelerate the adaptation of ZEV municipal and commercial bus fleets. Launched in 2021, the Zero-Emission Transit Fund (ZETF) is a 5-year, $2.75 billion federal program to support the electrification of Canadian municipal bus services and those of private sector school bus operators. This includes financial support for charging infrastructure and the purchase of about 5000 ZEV buses. Additionally, the Zero Emission Vehicle Infrastructure Program (ZEVIP), a 5-year $280 million program, addresses the lack of charging and refuelling stations in Canada and targets commercial and public fleets including light, medium or heavy-duty vehicles, taxies, last-mile delivery vehicles, municipal utility vehicles, forklifts, airport ground support vehicles, vehicles used in the mining, forestry or farming industries, or ice resurfacers.

The first best practices and case studies for the electrification of commercial fleets and the role that municipalities can play in this: In April 2021, the Pembina Institute published *Making the Case for Electric Urban Delivery Fleets in the GTHA*. It is the first of its kind study in Canada to explore the expected costs, energy demands and GHG-emission savings associated with a switch to electric cargo vans, specifically in the Greater Toronto and Hamilton Area (GTHA). This builds on international examples such as the detailed 2020 *Drivers and barriers to the electrification of inner-city logistics - Case Arkea Ltd. in Turku, Finland*. There are also the first regional hubs to facilitate the energy transition of fleets, such as the Edmonton Region Hydrogen HUB.

Municipalities as early adopters electrifying their fleets: In June, 2021 the City of Ottawa announced plans to become first Canadian city with a fully electric bus fleet. The city plans to replace its entire fleet of diesel buses with fully electric models by 2036. As part of its TransformTO climate action strategy, in 2019 the City of Toronto put into service its first ebuses with plans to electrify its entire bus fleet. Similarly, York Region's 2019 Corporate Fleet Electrification Plan envisions the transition to ZEVs for the region's entire fleet of municipal vehicles, from ambulances to Zambonis. Alberta's *Electric Vehicles for Municipalities Program* provides financial, educational and logistic support for the electrification of municipal fleets, from garbage trucks and ice resurfacers to trucks and city vehicles and pick-up trucks.

A BOLT TOWARD COMMERCIAL E-FLEETS IN CANADA

In summer 2021, Toronto-based storage and last-mile delivery company Bolt Logistics announced it is building Canada's largest commercial electric vehicle fleet and will be carbon negative by 2023. The move by Bolt is in large part due to the demands of one its primary costumers and investors, Ikea, whose sustainable business plan includes achieving 100% zero emission home deliveries by 2025.

Evidence-based Canadian research results on commercial fleet attitudes, behaviour and barriers and incentives to electrification: In the past several years the first Canada-specific fleet electrification research results have been published, for example the 2021 research paper "The demand for electrification in Canadian fleets" by University of Windsor transportation researchers Shakil Khan and Hanna Maoh. These Canadian studies provide business guidance data on issues from ZEV demand to fleet manager mindsets, and adaptation timeframes to the adequacy of existing electrical infrastructure. (*See our Airtable reading list for more reports*)

> *"Some businesses are willing to be very brave in [adaptation of] zero emission vehicles. Why? Because there's evidence that they are gaining contracts on that basis. If they're able to demonstrate they've got a zero emission fleet, they're getting either A, a longer supply of contracts for more years, or B, frankly, they're knocking out competitors because part of the criteria of doing business is providing ZEVs."*

E-FLEET SIGNALS, DRIVERS AND UNCERTAINTIES

Workshop participants identified a variety of key drivers, signals of change and central uncertainties that are shaping fleet electrification in Canada.

Municipal-scale is ideal for early adopters of fleet electrification: Participants emphasized that local-scale fleets, such as those for last-mile delivery, are the ones best positioned to be early adapters of fleet electrification. This is because these fleets generally have shorter, more frequent routes and thus are well-suited for existing battery range and recharging technologies.

CALIFORNIA DRIVING COMMERCIAL E-FLEET TRANSITION

California, the world's fifth largest economy by GDP, has historically been a driving force in the adaptation of vehicle emissions regulations and ZEVs, and thus is a bellwether of change. In September 2021, The California Air Resources Board (CARB) released its draft Advanced Clean Fleets regulation. It requires that, starting in 2025, owners van, truck and work vehicle fleets in California must make ZEVs an increasing percentage of their fleet. Beginning with Model Year 2040, manufacturers who sell medium- and heavy-duty on-road vehicles in California may only sell ZEVs. California is currently home to half of all ZEVs in the US.

> *"There are a lot of advantages to starting with a focus on urban centers. Given the lower distances and the more predictable routes that characterize urban transportation, it makes more likely that these vehicles can return to depots, reducing some barriers to electrification."*

Total life costing of e-fleet transition: Many participants noted that the economics of fleet electrification, and thus the decision points involved, are distinct from, for example, an individual consumer's purchase of a vehicle. For example, the up-front capital cost of installing fleet charging infrastructure can be as much, or more, than initial ZEV costs. On the other hand, longer-term operational savings (fuel) can be a bigger incentive for e-fleet transition, in particular because fleet vehicles are used more intensively over a shorter period of time.

> *"When we talk about electric buses, it is not just a piecemeal procurement. It's a complete energy transportation system transformation. It includes garage refurbishment, as well. And the cost for garage refurbishment and the supporting infrastructure and civil works costs can eclipse the cost of the buses."*

> *"Fleets and private sector organizations tend to have a stronger focus on the long run cost savings, the total cost of ownership. While consumers are sort of hyper-fixated on the upfront cost and don't care enough about the savings that they can have in the long run, that's a bit less of a barrier to the private sector organizations."*

A resale market is key to commercial fleet electrification: Currently, about half of commercial fleet vehicles are leased, and those that are owned are often sold after several years, making a reliable ZEV resale market very important.

> *"I would say that would be even more important than an initial [are structures to] help offload the vehicle and have it get into the secondhand market. That's a really big part for commercial vehicles. We know of examples of companies only keeping their trucks for two years, and then selling them. It's top of mind of how they're going to cycle vehicles."*

Bulk buying by combining orders to create critical mass: Municipalities can play a role in creating the critical mass, or scale, for adaptation of ZEV technologies by both municipal and commercial fleets. This can include brokering aggregate buying of ZEVs and charging infrastructure. Bulk buying by combining orders to create critical mass. Municipalities can play a role in creating the critical mass, or scale, for adaptation of ZEV technologies by both municipal and commercial fleets. This can include brokering aggregate buying of ZEVs and charging infrastructure.

"If our order is relatively small, we are at the end of a very long supply chain list, which is pushing a lot of that initial transition back, further. So, there could and should be a role for aggregated bulk buying."

Private financing of fleet electrification faces scale and risk challenges: Workshop participants involved in mobilizing private capital to help accelerate decarbonization noted that there are structural financial challenges that require creative solutions.

While we have financing partners at the table, there are a couple of issues. One, they want deals that are [at least] half-a-million dollars. Individual fleet electrifications are [often] not there yet. Number two, even if we can aggregate a number of fleets together to be of interest to a financing partner, when we get to the final investment decisions we don't yet have enough data on residual values. We can't make that data up. We're only going to get there through implementation. Finally, because these are new supply contracts, they're not very bankable. We get to the final risk assessments and the bank's chief risk officer will say, 'This isn't a 25-year business.'"

The technical challenges of new technology adaptation: Workshop participants noted that while ZEV technologies are currently available for much fleet electrification, there will be inevitable bumps in the process which will slow the transition. At the same time, there is a growing market of fleet electrification suppliers who are facilitating fleet electrification. For example, in October 2021, Ontario Power Generation, the province's leading electricity utility, launched PowerON Energy Solutions, a new subsidiary focused on selling turnkey solutions to help fleets identify charging needs and install related infrastructure.

"Bad [electrification transition] experiences can undo years of good will and work."

Fuel diversity presents fleet transition barriers: Workshop participants said that mixed technology fleets, for example, ZEVs and gas/diesel vehicles, present transitional challenges for fleet operators, such as more complex maintenance.

> *"At present, as [organizations] manage the transition curves to electric vehicles, they, in some cases, have to manage two or three different type of propulsion technologies. It could be they are diesel, they are natural gas, having electric bus. And in the case of California, some transit agencies are having an additional fuel cell electric bus, as well. So, having these four types of technologies with the same infrastructure that they have, that's the biggest choke point there."*

Integrating fleet electrification with grid infrastructure, electric utilities and municipal building codes: There is the need for municipalities to work with utilities and grid owners to ensure adequate infrastructure to support fleet electrification. Vancouver has published building code updates related to EV charging infrastructure, primarily for homes and multi-unit residential (apartments and condos) but also commercial, non-residential buildings, such as those that house fleets.

> *"We're working closely with our utility, for them to take into account our EV modeling. And we're working with them, so they take it into account on their planning for system upgrades."*

Fuel taxes and roadway maintenance: Participants noted that the question of gas-tax funded roadway maintenance is a complex and evolving issue in Canada, with broad provincial, and even intra-provincial variation. It is also a "hot button" issue, often raised by opponents of vehicle electrification as an insurmountable structural barrier. Thus, in parallel with the growth of ZEVs, municipalities must advocate for appropriate changes to the structure of the fuel-related tax base. This is already occurring via the The Canada Community-Building Fund (CCBF), formerly the federal Gas Tax Fund, and renamed in June 2021 because it's no longer tied to revenue from the federal gas tax. Every year about 3600 communities across Canada share in about $2 billion from the CCBF for municipalities to fund local transportation (and other) infrastructure projects, including roads, bridges and public transit.

BEHAVIOURAL NUDGES CAN ELECTRIFY FLEETS

Behavioural nudges are relatively modest actions that can have an outsized affect in effect in behavioural change. Workshop participants observed that municipalities both in Canada and internationally have already begun to use a variety of behavioural nudges to encourage fleet electrification. These e-perks include: parking privileges for ZEVs; ZEV-designated priority lanes; exemptions to toll and bridge fees for ZEVs; urban zero-emission zones and exemption from congestion chargers.

"In Norway they achieved pretty high penetration of ZEVs much faster than they expected through a broad package of incentives. I think they were actually quite surprised that this particular policy had some sort of leverage point that they didn't realize how important it was until they actually started seeing the purchases of electric vehicles increasing."

Municipalities' procurement policies can advance commercial fleet electrification: Cities and towns can include a preference for ZEV fleets when tendering supply contracts.

> *"One of the best ways to get companies to pay attention is to have their clients demand it. And one of those clients can be municipal organizations, as well. That's one way municipal organizations can have an impact by demanding, at least, accountability and transparency to be a part of their merit criteria."*

EQUITY AND FLEET ELECTRIFICATION

This scoping exercise found that until recently, very little policy consideration has been given to the question of social equity and a just transition in fleet electrification. In exploring the policy and research landscape for signs of change, the scoping exercise identified the following:

To date, ZEV adaptation in general has been by the white, male and wealthy: According to a recent review, ZEV buyers in the U.S. are mostly male, high-income, highly educated, homeowners, who have multiple vehicles in their household, and have access to charging at home. In California, the largest ZEV market in the US, buyers have a mean annual income of $190,000, three-quarters are men and four-in-five own their home and have a college degree.

Social equity in fleet electrification is an emerging issue of research, one that is creating a framework for discussing e-fleets through an equity lens: For example, a 2018 international review article, "*The neglected social dimensions to a vehicle-to grid (V2G) transition: a critical and systematic review*" notes that most ZEV studies focus on technical and economic issues, with GHG considerations a distant third, and social justice issues completely absent. However, in the past several years, as equity issues have gained greater political and public recognition in general, there's been emergent interest in proactively developing policy that takes into account the social impacts of fleet electrification. As a case in point, an August, 2021 *MIT Technology Review*, article "*A perspective on equity in the transition to electric vehicles*" notes, "As we progress toward goals of 100% electric vehicles, research and policy should consider how to establish a more equitable electric vehicle market so that the benefits are experienced by all and low-income households are not imposed with higher transportation costs."

Supply chain transparency will impact the EV sector in Canada and is a formidable global equity issue: New standards from the Sustainability Accounting Standards Board will impact extraction industries that produce the rare earth minerals found in ZEVs. Coupled with the federal government's exploration of supply chain transparency legislation, which would focus on exploitive labour practices, fleet electrification may face significant headwinds.

There is a need for a wider range and untraditional voices at the table in discussions about fleet electrification: Many of the people impacted by fleet electrification are, or will be, vehicle drivers. These drivers are often recent immigrants and other economically marginalized individuals. Thus the impact of electrification in terms of required behavioural changes will disproportionally impact low-income communities. This broader community of dialogue could facilitate both equity and fleet electrification, for example in the creation of a lower-cost, used ZEV market.

"Used electric vehicle incentives would be great for equity, too. And it would help on the commercial side. Part of the business—there are first buyers, second buyers, or third buyers. And all of this, when it comes to moving those big businesses [towards ZEVs] is sharing in the risk, making the value story make sense."

E-FLEET POLICY TAKE AWAYS

Municipalities have a variety of levers with which they can play a significant role in advancing commercial fleet electrification.

Local fleet electrification policy must recognize both technical and human opportunities, uncertainties and challenges: There are as many human factors, as technical ones, in the transition to fleet electrification. They range from relearning fuelling to fear of the unknown.

Commercial e-fleet adaptation is a stepwise process and challenge with distinct economics, for example stranded assets: Municipal officials must identify the particular challenges faced by local fleets and design incentives and behavioural nudges accordingly.

Municipalities can play a pioneering role in addressing the equity issues related to fleet electrification: There is a variety of up-to-date research to guide this action.

Fossil fuel to electricity-based tax structure: Municipalities should assess how the shift to fleet electrification, and ZEVs in general, may affect their federal and provincial tax-based transfers.

Municipal investment in public charging infrastructure can accelerate e-fleet transition: Many fleet managers are concerned with the availability of public charging infrastructure. Policy instruments geared towards the expansion of public charging infrastructure could promote fleet electrification.

Incentivize on-site charging infrastructure: The availability of charging infrastructure is seen as a significant barrier affecting fleet electrification. Municipal policies, such as building code changes and incentives to build on-site charging infrastructure could drive fleet electrification.

Public education and awareness campaigns: Municipal governments could play a critical role in shaping commercial fleet operators' perceptions of ZEV technologies and the benefits of fleet electrification.

Fleet electrification as part of municipal climate action plans: Given the major contribution of transportation to municipal GHG emissions, fleet electrification incentives should be a key part of municipal GHG reduction plans.

Conclusion & Call to Action: A More Inclusive Dialogue

This Discussion Paper provides a compelling snapshot of the complexities involved in equity-based responses to three areas of municipal infrastructure renewal at a critical moment in Canada's efforts to implement the SDGs and address the climate emergency.

It reveals that there are an enormous number of SDG-informed emergent, creative solutions in the areas of NZH, fleet electrification and stormwater management.

What's also abundantly clear to us, the three project partners who implemented this research project, is that as an SDGs community we face a major challenge: engaging a broader range of equity-seeking communities in the SDGs-related planning and decision making process.

For example, NZH and affordable housing are both major challenges—yet, while this Discussion Paper notes positive first steps, for the most part in Canada, policy discussions about one are taking place without meaningfully addressing the other.

These are not zero-sum issues: the SDGs include both social justice goals and GHG emission targets. We have the opportunity to address the climate crisis, and also the affordable housing crisis. There's a similar need for more participatory planning with both stormwater management and fleet electrification.

To achieve this is going to require a broader, more inclusive dialogue than has ever taken place in Canada around the SDGs, social equity and Indigenous reconciliation.

How do we engage equity-seeking and Indigenous communities around the broader SDGs issues and vice versa? How do we all get around the same table to envision a common future? This must be our next step.

We propose a series of dialogue events to begin to achieve this. These events should be designed in collaboration. The conversations must be focused on collective action. And they should be iterative so we can build the path towards the collective future we want.

JUST GREEN CITIES

SHARE THIS DISCUSSION PAPER WITH COLLEAGUES.

Get in touch with feedback:

justgreencities.ca

Julie Wright, Project lead
Partners for Action, University of Waterloo
Julie.a.wright@uwaterloo.ca | 519-888-4567 x 48938

Tell us about your SDG-driven municipal infrastructure initiatives.

Let us know whom else we should be engaging.

Join with us in using this Discussion Paper to fuel action-oriented, next-step discussions in order for us to collectively build a shared future of Just Green Cities.