DESIGNING SMART & SUSTAINABLE COMMUNITIES

ICTC Smart Cities Roundtables:
Smart Energy and Environment
February 2021

Research by

The Information and Communications Technology Council

This project is funded in part by the Government of Canada's Sectoral Initiatives Program

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

Preface

The Information and Communications Technology Council (ICTC) is a not-for-profit, national centre of expertise for strengthening Canada's digital advantage in a global economy. Through trusted research, practical policy advice, and creative capacity-building programs, ICTC fosters globally competitive Canadian industries enabled by innovative and diverse digital talent. In partnership with an expansive network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 25 years.

About the Smart Cities Project:

ICTC is leading a multi-year national research initiative on smart cities. Under this project, ICTC investigates the development of smart cities across Canada and internationally, with the ultimate goal of understanding the labour, technology and societal needs and opportunities of Canada's future communities. To guide and shape this research, ICTC has chosen the following areas of focus: Smart Infrastructure, Smart Mobility, Smart Energy & Environment, Smart Health & Wellbeing, Smart Government, and Smart Regulation. During the course of this study, ICTC is hosting policy roundtables on each of these pillars. The first roundtable was on Smart Infrastructure and took place in November 2019. These roundtables engage a variety of stakeholders across Canada to uncover specific policy needs and put forward recommendations that can support a smart future for our cities.

To cite this brief:

Matthews M., and Rice, F. "Designing Smart and Sustainable Communities: ICTC Smart Cities Roundtable on an Energy Transition for Canada" (March 2021), *Information and Communications Technology Council.*

Researched and written by Faun Rice (Senior Research & Policy Analyst) and Mairead Matthews (Research and Policy Analyst) with generous support from Alexandra Cutean (Senior Director, Research and Policy), Khiran O'Neill (Research and Policy Analyst), and the Digital Think Tank by ICTC team.

Contents

Preface 3

Introduction 5

Setting the Stage 6

ICTC Smart Infrastructure Roundtable 14

- Challenge One: Redefining Prosperity through Economic Policy 14
- Challenge Two: Technology and Tech Policy Needs for a Sustainable Energy Transition 17
- Challenge Three: Individual and Community Action 21

Conclusion 25

INTRODUCTION

ICTC's Smart Energy and Environment Policy Roundtable on December 3rd, 2020, was the second event in a series on creating a vibrant and inclusive smart economy for Canada. Dr. Sarah Burch, Canada Research Chair in Sustainability Governance and Innovation, and Sonya Hull, a leader in smart infrastructure and digital grids at Siemens Canada Ltd., opened the discussion with two presentations on Canada's energy future. In the event's second hour, an invited group of 30+ attendees from industry, government, academic institutions, and civil sector organizations were led in discussion by ICTC facilitators. Participants were broken up into four smaller discussion groups with a series of challenge-based questions to address.

Together, the speakers and roundtable participants discussed environmental priorities for federal, provincial, and local policy; technology needs for energy transitions; and community-led initiatives for a sustainable future for Canada. This policy brief distills the priorities outlined by roundtable attendees. The event highlighted the need for coordination and targeted efforts from all levels of Canadian society, including strong collaboration between the public and private sectors, inter-provincial agreements and infrastructure, and community-driven energy generation.

Setting the Stage

Insights from Sustainability Leaders

The Smart Energy and Environment Roundtable kicked off with two presentations by Dr. Sarah Burch, acclaimed sustainability and climate change scholar and Sonya Hull, a digital grid expert at Siemens Canada. Dr. Sarah Burch holds a Canada Research Chair in Sustainability Governance and Innovation and is an Associate Professor in the Department of Geography and Environmental Management at the University of Waterloo. She is an expert on transformative responses to climate change at the community scale, innovative strategies for making progress on sustainability, and the unique contributions that small businesses can make to solving this complex challenge. Sonya Hull is a Digital Grid and Smart Infrastructure Consultant at Siemens Canada and a founding member of the Smart Grid Innovation Network, a partnership between NB Power, Siemens and UNB. She consults on business transformation and grid modernization (smart grid) solutions in the electric utility sector.

To begin, Burch's presentation tackled big ideas: the size, depth, and urgency of the challenge presented to us by climate change; individual and group definitions of sustainable economic growth and how these definitions shape climate action; and balancing sacrifice and progress in sustainability initiatives. Following this, Sonya Hull's presentation provided a look at the work that Siemens Canada does in smart and clean energy and gave some very tangible examples of how Canada can transform its energy systems to make them more sustainable: the Brooklyn Microgrid project, Smart Grid Atlantic, and the Shediac Smart Energy Community Project.

Dr. Sarah Burch: Climate Change Urgency and Finding Balance in Climate Action

Burch began her talk by discussing sustainability and prosperity, two important terms in the study of climate change. She proposed that there is no single definition of either term and therefore no single vision of what sustainability and prosperity might look like. Each community will have their own unique understanding of sustainability and prosperity, based on local resources, infrastructure, habits, and values.

For example, in response to the COVID-19 pandemic in March 2020, both New York and Paris went into complete lockdown for approximately one month. In that time, it is estimated that in Paris, total carbon emissions decreased by an astounding 72%, while in New York emissions decreased by just 10%.[1] Burch asked the audience: "What might be the reason for the 62% discrepancy?"

As it turns out, it has a lot to do with the habits, values, resources, and infrastructure of each city. Burch explained that in Paris, the majority of greenhouse gas (GHG) emissions come from transportation—specifically single occupancy vehicles—and during the lockdown when those vehicles were not being driven, emissions went down significantly. In New York, on the other hand, the majority of emissions come from buildings. Despite the lockdown, the need to heat and cool buildings using natural gas and oil persisted and, as a result, emissions remained relatively stable. **Sustainability means different things for different communities.**

Burch then addressed the why of sustainability and climate change initiatives: "What is pushing us to have conversations about the new ways our communities might function?"

For one, as the earth comes dangerously close to a number of "tipping points," the global population runs the risk of pushing the earth's environmental systems into "zones of deep uncertainty" (see Figure 1). These tipping points or "planetary boundaries" were identified by a group of researchers at Stockholm University in 2015.[2] They include things like biosphere integrity, biogeological flows, land system change, ocean acidification, and climate change. To date, research shows that we have transgressed at least four of these planetary boundaries—one being climate change—and all of them have already had significant implications for the frequency and severity of extreme weather events, such as storms, droughts, and precipitation, in addition to rising sea levels and desertification. As Burch put it, "We are already seeing the impacts of climate change today—it is not a future phenomenon, but a current one."

1 Matt McGrath, "Climate change and coronavirus: Five charts about the biggest carbon crash," March 5th, 2020, BBC, https://www.bbc.com/news/science-environment-52485712

2 "About the Research," 2021, Stockholm Resilience Centre, https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research.html

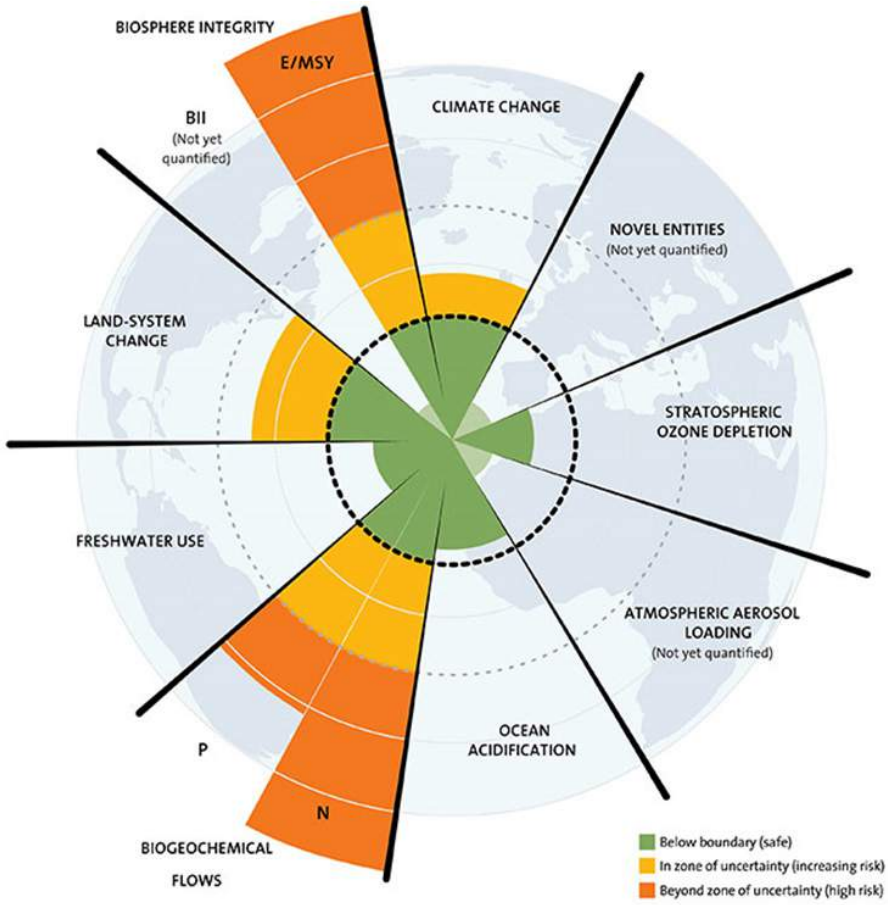

Figure 1. The Nine Planetary Boundaries.

Source: J. Lokrantz/Azote based on Steffen et al. 2015. See: "About the Nine Planetary Boundaries," 2015, Stockholm Resilience Centre, https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html

The second "why" provided by Burch is the "incredible acceleration of human activity" over the last century. Research conducted by the International Geosphere Biosphere Programme demonstrates the trajectory of 24 socioeconomic and earth system indicators from the early 1900s until 2010 (see Figure 2).[3] Mapped out, these indicators form a series of exponential curves that make visible the staggering growth of the global population, and with it, the growth of many other things, including gross domestic product (GDP), GHGs, fertilizer consumption, surface temperature, water use, and paper production.

3 Steffen, W., et al., "The trajectory of the Anthropocene: The Great Acceleration," January 16, 2015, Stockholm University, the Australia National University, and International Geosphere-Biosphere Programme, https://journals.sagepub.com/doi/abs/10.1177/2053019614564785?journalCode=anra

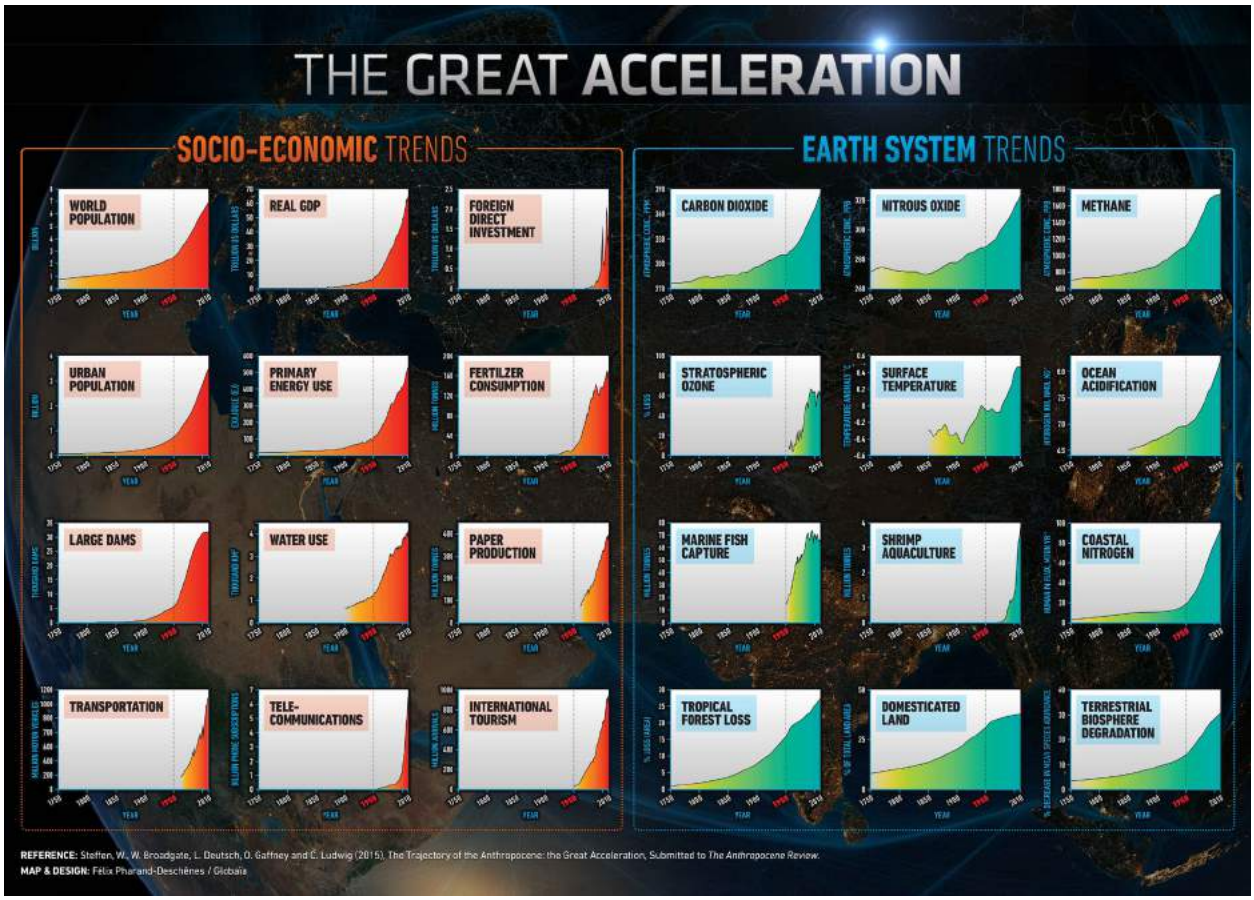

Figure 2. The Great Acceleration.

Source: Adapted from Steffen et al., Global Change and the Earth System, 2004. See: "Great Acceleration," 2021, International Geosphere Biosphere Programme, http://www.igbp.net/images/18.950c2fa1495db7081ebd1/1421396650502/GreatAcceleration2015igbpsrclowres.jpg

Burch explained that the nine planetary boundaries and great acceleration indicators both point to an incredibly urgent challenge and the need for "diverse and creative solutions, fast." Yet the impact of the COVID-19 pandemic has also taught us that not all carbon reduction is equal. It is estimated that in 2020, due to international lockdowns and economic closures, global carbon emissions decreased by around 8%—the approximate level of reduction that is needed to achieve 2050 net-zero emissions targets. Unfortunately, this 8% reduction in emissions came alongside tremendous loss in human lives, the mass destruction of human livelihoods, and a significant toll on mental health. Looking forward, what is needed is a way to achieve this same level of reduction without such tragic impacts on human health, happiness, and prosperity.

With these challenges front and centre, Burch finished her talk with an overview of what might be done in Canada to address climate change going forward. For one, Canada has a lot to offer in terms of renewable energy resources and, until recently, these resources have been under-developed and under-capitalized. Canada also has many

cities where it is much easier to drive than to walk or use alternative transport: this creates a strong dependency on cars. Similarly, there are many cities with sparse green space and a lot of non-permeable surfaces like concrete, which stops stormwater from seeping into the ground and creates flood risks. Canada also has very low-density cities with a high proportion of suburbs. In this urban sprawl, many communities lack essential services. **These challenges provide countless opportunities for transformative systemic change at the community level: the adoption of mass transit, active transportation, local food production, compact communities, permeable surfaces, green space, and renewable energy.**

Finally, Burch highlighted that sustainability in the private sector in Canada needs to focus more on its small to medium sized enterprises (SMEs). While it is often "big, splashy examples" that come to mind when we think of private sector sustainability—for example, big brand names or Fortune 500 companies—the Canadian economy is mostly made up of SMEs.[4] Individually, their GHG emissions are relatively low, but collectively, SMEs produce more than two hundred million tons of GHGs every year, which Burch said is roughly equivalent to the emissions from Canada's transportation sector. This means that the sustainability initiatives pursued by SMEs can have a big impact. SMEs can be incredibly agile and are inherently more nimble than large corporations with complex organizational structures and hierarchies. Unfortunately, they are also acutely affected by financial crises like the COVID-19 pandemic, which critically impact their ability to take on new sustainability initiatives. According to Burch, only a small percentage of SMEs have taken up sustainability initiatives, and those that have, most often pursue a "resource efficiency approach to sustainability," meaning only incremental improvements in the way they use resources. These contrast with transformative changes where companies "dig down to the roots, values, and purpose of their business" and transform their core business model. Burch finished her talk by highlighting a unique opportunity: **"The COVID-19 pandemic provides an unparalleled, if entirely tragic, opening to pursue a recovery that is itself sustainable, just, and inclusive." Failing to meet this opportunity would lock Canada into a future pattern of high-carbon growth.**

4 SMEs make up 99.8% of all businesses in Canada. "Key Small Business Statistics - January 2019," Government of Canada, December 6, 2019, https://www.ic.gc.ca/eic/site/061.nsf/eng/h_03090.html

Sonya Hull: Transforming Canada's Energy Systems

Sonya Hull began by introducing her work at Siemens Smart Infrastructure Digital Grid, laying the groundwork for her talk on smart energy and building a low carbon electricity system. She showed a short video[5] on the Brooklyn Microgrid project, explaining that it combined environmental ethics, local control over energy systems, and technological advancement.

Next, Hull discussed important trends in human organization. Globalization, urbanization, and climate change paired with new flexible work environments have produced new challenges related to population growth. One of her slides showed the amount of time that people spend indoors, highlighting that a variety of surveys have found North Americans spend approximately 90% of their time inside.[6] Hull related this statistic to Burch's discussion of energy consumption in buildings around the world. She noted that, although we take electricity for granted, transforming our energy system will have a resounding impact on carbon emissions at a global level.

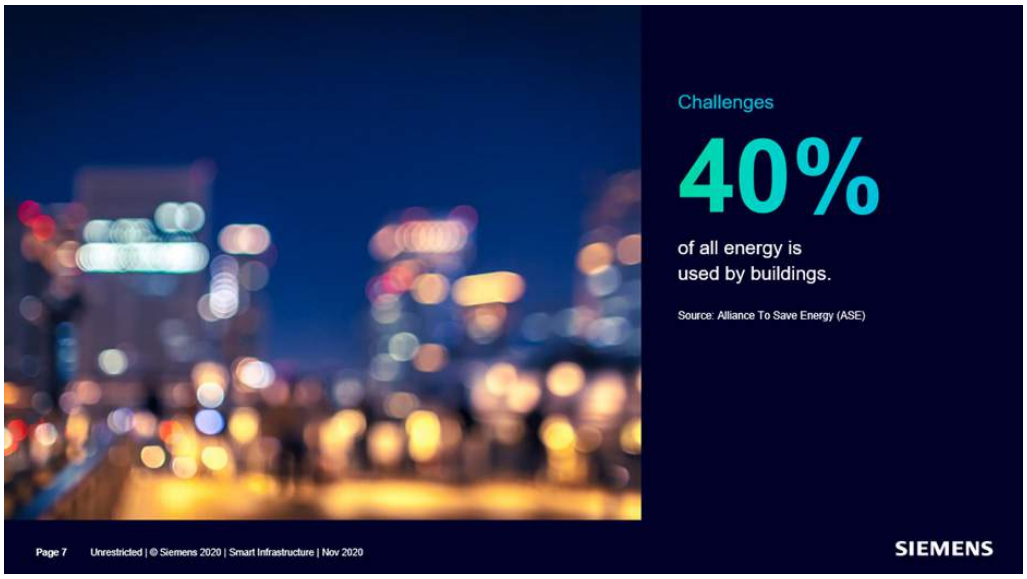

Figure 3: Excerpt from Sonya Hull's presentation on Dec 3, 2020, reproduced with permission from speaker.

Why Smart Energy?

Hull explained that despite all the trends described, the traditional power grid has not adapted quickly. Its century-old design did not consider integrating a variety of renewable energy resources from decentralized locations.

5 LO3 Energy,"LO3 Energy's Brooklyn Microgrid project," May 4th, 2018, YouTube, https://www.youtube.com/watch?v=LxIMmFKOSUY

6 For example, Americans in the 1990s spent 87% of their time indoors, while a later study (2018) raised that figure to 90%. See, Neil E. Klepeis et al., "The National Human Activity Pattern Survey (NHAPS): A Resource for Assessing Exposure to Environmental Pollutants," Journal of Exposure Science & Environmental Epidemiology 11, no. 3 (July 2001): 231–52, https://doi.org/10.1038/sj.jea.7500165 ; "The Indoor Generation," Veluxusa.com, n.d. (accessed January 15 2021).

While Canada primarily uses hydroelectricity, other provinces still rely on coal, natural gas for heating, and oil for transportation nationwide. Smart energy provides an opportunity to ensure that clean power can be used across Canada. By moving to an entirely electric energy system (including transportation) and by generating more electricity from renewable sources, Canada can use smart energy tools to immensely reduce its GHG emissions.

Innovation "at the Edge of the Grid"

Homes and office spaces exist "at the edge of the grid," but technologies like rooftop solar panels and small wind farms allow consumers to become producers of electricity, as illustrated by the Brooklyn Microgrid video. Small producers can sell to their neighbours, store their energy, or perhaps sell it "back to the grid," all orchestrated by a smart grid.

Beyond Brooklyn, the Smart Grid Atlantic initiative (federally funded with partners NB Power, Nova Scotia Power, and Siemens) is focused on achieving this reality in Canada. For example, the Shediac Smart Energy Community Project is building a community solar farm, running a residential smart energy study and converting commercial buildings to net zero properties.[7] Other similar projects in Atlantic Canada are piloting homes with smart energy nanogrids, neighbourhood micro-grids, and other community-based trials of smart energy technology.

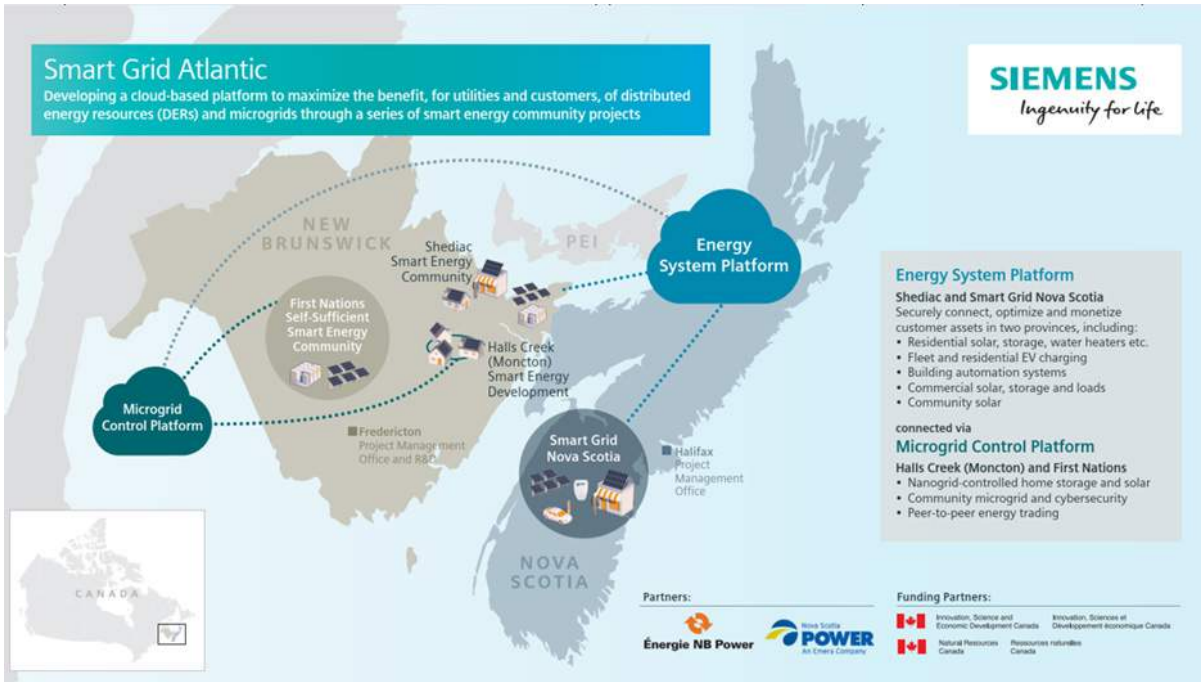

Figure 4: Excerpt from Sonya Hull's presentation on December 3, 2020, reproduced with permission from speaker.

7 "Shediac Smart Energy Community Project," nbpower.com, 2020 (accessed January 15, 2021).

In closing, Hull emphasized how important it is to begin this slow and complex transition immediately: "**The transition will happen incrementally. We're not just jumping from fully centralized power based on fossil fuels, straight to wind and solar.** We have to transition and make sure that society can depend on the power system, that it's reliable. We have a commitment and a duty to make sure that we have a secure and stable power system. Smart technologies can take us there: the future will be in local distributed power, along with regional solutions like hydro."

ICTC Smart Energy and Environment Roundtable Discussion: Key Takeaways and Recommendations

Following the guest presentations, invited attendees joined in a roundtable discussion under the Chatham House Rule. The roundtable was broken into three topics. The discussion began with questions of economic policy, moved through technology needs for energy transitions, and concluded with a conversation about what sustainable communities look like locally.

CHALLENGE ONE: REDEFINING PROSPERITY THROUGH ECONOMIC POLICY

Prompt: Burch's talk proposed that the term "prosperity," closely linked to economic development, could be reconceptualized to include priorities like health, wellbeing, environmental integrity, and care for future generations. As a starting point, prosperity and economic development must include some concept of environmental harm or wellbeing to ensure a sustainable future. *Facilitators asked: What should a new working definition of "economic development" or "prosperity" include or exclude? How should it be operationalized—through what policies, actions, or agreements, and in what jurisdictions?*

Key Conclusions:

To redefine prosperity, we must also shift concepts like productivity, competitiveness, and capital by considering wellbeing, inequality, and the environment. Many participants brought up gross domestic product (GDP), a ubiquitous metric for national productivity. They commented that what we include or exclude in GDP can be altered, and these decisions play a role in environmental sustainability and wellbeing. One participant noted the work being done by the Organization of Economic Cooperation and Development (OECD) to develop wellbeing indicators for measuring national prosperity, including the Better Life Initiative.[8] This work suggests that, in many countries, GDP growth also widens inequality and undermines sustainability goals.[9] One participant noted that on a personal level, it feels like there is no longer a direct link between labour and quality of life, that Canada and other developed countries are seeing significant inequality growth, alongside increased environmental and social harms, despite a healthy GDP.

Wellbeing includes food security, housing security, local economic development, and income equality, all of which are tied to both environmental sustainability and a prosperous economy. In other words, it does not make sense to grow GDP at the expense of the environment. A "prosperous economy" should consider the above components of wellbeing. Similarly, across more than one discussion group, participants asked whether all indicators of success must "grow"—for example, the rate at which countries can shrink income inequality or carbon emissions could also be considered a standard of international competitiveness.

Finally, several participants invoked concepts from ecological economics, suggesting that **measurements of prosperity should be shifted to include what we typically think of as "externalities" (such as environmental harm) using concepts such as natural capital[10] or the circular economy.**[11] An externality is any cost or benefit that is caused by economic production but is not incurred by the producer themselves (instead, the cost or benefit is imposed on a third party).

---

8 "Better Life Initiative: Measuring Well-Being and Progress," OECD.org, 2020, accessed January 4, 2021, https://www.oecd.org/statistics/better-life-initiative.htm.

9 For example, the contention that contemporary economic policymaking should account for "environmental sustainability – understood as a path of rapidly declining GHG emissions and environmental degradation, consistent with avoiding catastrophic damage and achieving a stable and healthy level of ecosystems services," in Secretary General Advisory Group, "Beyond Growth: Towards a New Economic Approach," Organisation for Economic Cooperation and Development, September 12 2019, https://www.oecd.org/naec/averting-systemic-collapse/SG-NAEC(2019)3_Beyond%20Growth.pdf, pp. 6-7.

10 Natural capital has been defined as a "'stock that yields a flow of valuable goods or services into the future'…For example, a stock or population of trees or fish provides a flow or annual yield of new trees or fish, a flow that can be sustainable year after year" (p. 38). Natural capital has been used as one way to incorporate finite environmental resources into economic planning, using policies such as a natural capital "depletion tax." See, Robert Costanza and Herman Daly, "Natural Capital and Sustainable Development," Conservation Biology 6, no 1, March 1992, pp. 37-46.

11 Where "a circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models." In, "Towards the Circular Economy: Economic and business rationale for an accelerated transition," Ellen MacArthur Foundation, 2013, https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf, p. 7.

For example, in jurisdictions where there is no price on pollution, whether that be a price on carbon emissions or material waste, any pollution resulting from economic production becomes an externality. In this model, costs associated with the pollution are therefore not incurred by the producer (in the form of a fee or tax charge) but by society at large (in the form of climate change impacts, such as droughts or floods).

Practical implementation of these ideas (redefining GDP, measuring wellbeing effectively, and including environmental externalities in economic calculations) requires clear leadership from policymakers, significant financial support for an energy transition, and a cultural shift within the Canadian public. Specifically, participants noted the need for clear and enforceable goals. For example, while many participants welcomed the Canadian government's emphasis on achieving carbon neutrality by 2050,[12] several also commented that Canada's poor track record in meeting climate targets meant that public trust in the sincerity of these goals was faltering.[13] In addition, both energy-sector stakeholders and Canadian communities, many of which currently rely on energy-sector jobs, must have a reason to trust and buy into a national energy transition strategy. All jurisdictions and levels of society have a huge role to play in creating a sustainable future for Canada, and the subsequent two discussion topics explore in greater detail policy alternatives and community roles.

12 Government of Canada, "Net-Zero Emissions by 2050," Canada.ca, December 12, 2020, https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html.

13 Canada has so far missed five of its own carbon emissions targets. See Aaron Wherry, "Why Canada might need a climate law—and how it might work," CBC News, Jun 16, 2020, https://www.cbc.ca/news/politics/climate-change-emissions-canada-trudeau-kyoto-1.5613108.

CHALLENGE TWO: TECHNOLOGY AND TECH POLICY NEEDS FOR A SUSTAINABLE ENERGY TRANSITION

Prompt: A sustainable definition of prosperity only gets us so far: to achieve its climate goals, Canada needs to transform its energy system so that it causes less environmental harm. As demonstrated by Sonya Hull's presentation on smart grids, there are many tangible ways to achieve an energy transformation. With this as a starting point, facilitators asked: *What technologies play a role in energy transformation? How should they be integrated, and what challenges exist? At what levels should they be integrated? What policy levers are required to aid this transition?*

Key Conclusions:

There are numerous small players in Canada's cleantech ecosystem. Currently, few of them have sufficient backing from investors and policymakers, or the infrastructure that they need to scale their solutions, let alone a coordinated approach that would allow them to function as a broadly effective network. Participants brought up solutions such as geothermal heat pumps and noted that they are not commonly used because of their high upfront cost (despite rebates) and contractors' unfamiliarity with installing them. Similarly, attendees commented that many cleantech solutions require more capital and patience: techniques such as using artificial intelligence (AI) solutions

to reduce emissions are rarely given the research and development time they need to be strong alternatives, while technologies like carbon capture and storage (CCS) and methane sequestration are promising but undercapitalized. Overall, participants felt that Canada was too reliant on American innovation, and that the Canadian clean and renewable technology space needed more capital, better leadership, and better coordination.

National strategy and green procurement are both strong tools for increasing investment, research, development, and implementing clean and renewable technologies. Several participants discussed the federal hydrogen strategy,[14] not yet published but broadly anticipated at the time of this event, as a hopeful move. However, they also debated the merits of subsidizing "blue" and "green" hydrogen.[15] Other jurisdictions such as the EU have demonstrated the value of pairing strong public procurement signals with national strategy: if a public body sets clear targets for green procurement, it creates greater certainty for private investors in that space.[16] Participants noted that other types of cleantech subsidies and initiatives could learn from well-designed national strategies. For example, while Electric Vehicle (EV) subsidies exist, persistent high costs and the burden of insufficient charging infrastructure continues to be a significant barrier to wider adoption.[17] Overall, participants felt that there was a clear need to invest more (and more reliably) in clean technology, remove cost burdens from consumers, and fund such programs through carbon pricing and other levers. In addition, participants suggested developing resources that could provide supportive frameworks for cleantech and renewables, such as renewable- and cleantech-friendly building codes,[18] better battery storage for renewable energy, and adopting a coordinated approach that could effectively heat and light large areas rather than focusing on individual homes or buildings.

Canada's energy-focused economy provides some of the biggest challenges and opportunities for a renewable transition. Across the board, participants agreed that it was both necessary and difficult to transition away from relying on oil and gas. However, with some oil and gas companies taking a leading role in diversifying their business

14 Released after the event at Natural Resources Canada, The Hydrogen Strategy, December 2020, https://www.nrcan.gc.ca/climate-change/the-hydrogen-strategy/23080.

15 While hydrogen itself is emission-free, there are different production mechanisms, and the electricity required to produce hydrogen can come from fossil fuels ('grey' hydrogen), fossil fuels with carbon capture technologies ('blue'), or renewable energy sources ('green'). See an example discussion of this in Canada at: Quentin Casey, "Green or blue?: Quebec eyes overtaking Alberta to emerge as Canada's hydrogen hub," Financial Post, Dec 30, 2020, https://financialpost.com/technology/green-or-blue-quebec-eyes-overtaking-alberta-to-emerge-as-canadas-hydrogen-hub.

16 Along with the landmark European Green Deal, the EU employs several values-driven procurement initiatives. See for example, "Green Public Procurement," European Commission, Accessed January 13 2021, https://ec.europa.eu/environment/gpp/index_en.htm.

17 Importantly, while participants did not raise the Zero Emission Vehicle Infrastructure Program or others being run by departments such as Natural Resources Canada, there are several attempts to improve EV infrastructure access in Canada. See, "Zero Emission Vehicle Infrastructure Program," Natural Resources Canada, modified December 11, 2020, https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-transportation/zero-emission-vehicle-infrastructure-program/21876.

18 Participants suggested building codes that considered carbon emissions, had higher insulation standards, and incentivized installation of solar panels or other zero-emission energy sources. In addition, they raised the construction and manufacturing industries' production of cement, steel, and other goods as an area with big potential to cut emissions.

activities, some participants saw an opportunity to "use the momentum of our existing companies to produce the technologies we need to get to net zero." Others contended that this transition was not happening quickly enough, and that some partners in the extractive industry were unwilling to invest adequate funds in renewable and cleantech research and development. Overall, participants saw several policy opportunities to accelerate energy sector transition, including removing fossil fuel subsidies, pricing high-carbon products and emissions more appropriately, providing additional subsidies for renewables, and adjusting other policy levers like flow-through shares to focus on cleantech rather than extractives.

We need to incentivize investment in renewable energy and clean technologies from all directions, and this includes building consumer confidence. Participants claimed that clean technology and policy pilots have historically suffered from inconsistent implementation and funding following administration changes. Consumers need to be able to trust that programs like rebates will last in order to confidently undertake home renovations, for example. In addition, some Canadians might be worried about the changes that could come with an energy transition, such as job loss, economic uncertainty, or a loss of privacy with technologies like smart grids. A recent report found that there are 18 Canadian communities where fossil fuel industry jobs account for more than 5% of total employment: these communities must be justly included in Canada's energy transition.[19] Policymakers must also underscore the quality-of-life benefits of reducing carbon emissions, as well as the job opportunities enabled by an energy transition and the diversification of the Canadian economy, if done well. Furthermore, Canadian concerns about new and unfamiliar technologies should be treated seriously and with consideration, such as by improving data privacy and developing clear rules for data-sharing in smart grids.

Canadian jurisdictions need to collaborate for a national energy transition to be effective. Attendees commented that the lack of an enforceable national energy strategy left the country with piecemeal provincial efforts. While inter-jurisdictional differences might lead to healthy competition (e.g., for "Canada's greenest city"), it also means that nationwide strategies might face challenges, as seen with Canada's

19 While there is no clear answer as to how many fossil fuel jobs would be lost and how many clean tech or green energy jobs would be created in Canada by a renewable energy transition, there have been several estimation attempts. A recent study found that while the transition to renewable energy would remove approximately 8,500 fossil fuel jobs from the economy each year for 20 years, the Canadian economy generally creates this many new jobs every 10 days. Further, more than half of the lost jobs would likely be absorbed through attrition. See: Stanford, J., "Employment Transitions and the Phase-Out of Fossil Fuels," January 2021, The Centre for Future Work, https://centreforfuturework.ca/wp-content/uploads/2021/01/Employment-Transitions-Report-Final.pdf.
Clean Energy Canada estimates that "Canada's clean energy sector is on track to employ 559,400 Canadians by 2030," while Solas Energy Consulting estimates that by 2030, Alberta will see approximately 8,800 new solar jobs annually. See: Gallagher, J., et al. "Alberta's Solar PV Value Chain Opportunities," November 2018, Solas Energy Consulting, https://solaralberta.ca/learn/publications/albertas-solar-pv-value-chain-opportunities-report/#page=7 and "The Fast Lane," October 2019, Clean Energy Canada, https://cleanenergycanada.org/wp-content/uploads/2019/10/Report_TER2019_CleanJobsFuture_20191001_FINAL.pdf
Finally, the Columbia Institute, in a report commissioned by Canada's Building Trades Unions, estimates that "meeting Canada's climate goals could generate over 3.3 million direct jobs" in construction and trades. See: Bridge, T., and Gilbert, R., "Jobs for Tomorrow," October 2017, Columbia Institute, https://columbiainstitute.eco/wp-content/uploads/2017/09/Columbia-Jobs-for-Tomorrow-web-revised-Oct-26-2017-dft-1.pdf

recent court debates over federal carbon pricing.[20] Numerous participants commented on the complex state of inter- and intra-provincial energy transmission and the potential for more integration of independent power producers (IPPs), noting that more transmission lines and opportunities for IPPs would help communities develop clean and renewable power initiatives that could not only sustain them but also be sold back to the grid.[21] Many participants advocated for more of a shift toward distributed power generation and demand-side management (DSM) tools such as smart meters, commenting that provincial utility companies had a mixed track record in this area, either using their public mandate to advance new clean energy technologies or acting as monopoly powers that precluded new clean technologies from entering the marketplace. Overall, attendees applauded those utilities that were investing in smart grids, smart meters, and local energy producers, and expressed a desire that more provinces make similar investments.

20 Ted Brook, "Climate change and Canadian federalism: previewing the arguments to the Supreme Court of Canada regarding the constitutionality of Parliament's Greenhouse Gas Pollution Pricing Act," Norton Rose Fulbright, March 2020, https://www.nortonrosefulbright.com/en-ca/knowledge/publications/d0fa8dbd/climate-change-and-canadian-federalism.

21 A number of policy measures have implications for this topic. For example, proposed amendments to BC's Clean Energy Act will repeal the requirement that the province maintain electricity self-sufficiently, allowing BC to purchase surplus renewable energy outside of Canada (and from sources other than Canadian IPPs). See for example, "Electricity regulation in Canada: overview," Thompson Reuters Practical Law, August 1 2020, Accessed Jan 13, 2021, https://ca.practicallaw.thomsonreuters.com/5-632-4326?transitionType=Default&contextData=(sc.Default)&firstPage=true.

CHALLENGE THREE: INDIVIDUAL AND COMMUNITY ACTION

Prompt:

Many of the priorities for technology and policy, such as building more transmission lines between provinces, also impact communities and their ability to access clean energy, develop their own energy sources, and benefit from locally driven clean technology projects. We know that community actions, supported by the right infrastructure and policy levers, can have a powerful impact on the environment. With this starting point, facilitators asked: *What individual and community-led actions are most impactful at this time? What support do individuals, communities, and/or municipalities need to design and create sustainable communities?*

Key Conclusions:

Canadian communities are diverse, and it is important that we take steps to include communities of all kinds in smart environment conversations. Like Sarah Burch, participants highlighted that "smart environment" can mean something different to everyone. For a northern community that is living off-grid, it may mean taking steps to get on the grid or building a small renewable energy production facility to not only reduce the environmental impact of diesel or coal-based electricity but also eliminate overwhelming health threats associated with fossil fuel.[22] Alternatively, for communities like Shediac and Moncton in New Brunswick, it may be about experimenting with new smart grid technologies to improve the way utility customers engage with their electricity grid.[23] In order to include communities of all kinds in these conversations, smart environment imagery and rhetoric cannot only allude to urban agendas for hyper-urbanized communities. By looking to the many leaders in remote and rural regions who have piloted highly innovative projects, we can inspire the use of data and technology for environmental benefit in all of our communities.

If we limit our smart environment planning to urban settings, we also limit how effective these solutions will be across Canada. For example, if we focus too much on designing urban solutions, we may not adequately consider how they translate to rural contexts. One participant cautioned that many of our assumptions about building energy efficient and sustainable communities are pinned to urbanization: that is to say they rely on the continuing urbanization of our population. While it is still too soon to assess the impact of the pandemic on long-term urbanization trends, the rising importance of the knowledge-based industries and increased prevalence of telecommuting has already resulted in significant uncoupling between cities and high-paying jobs. It is also clear that for a subset of the Canadian population, moving from the city core to a suburban, satellite, or rural community is now a definite priority.[24] Amid these trends, it is critical that we find ways to make communities in more rural areas sustainable—both those that have long existed and those that are just taking shape.

22 "Remote communities in Canada, the majority of which are Indigenous, are overwhelmingly reliant on diesel fuel for heating and electricity generation. Burning diesel for heat and power creates local health and environmental issues, and diesel must be transported into hard-to reach communities at high cost" See Lovekin, D., et al., "Diesel Reduction Progress in Remote Communities," July 6, 2020, Pembina Institute, https://www.pembina.org/reports/diesel-reduction-progress-research-summary-pdf.pdf

23 "Smart Grid Atlantic," 2020, NB Power, https://www.nbpower.com/en/smart-grid/smart-grid-atlantic/

24 A recent survey conducted by Leger on behalf of RE/MAX Canada found that following the pandemic, "32 per cent of Canadians no longer want to live in large urban centres, and instead would opt for rural or suburban communities." Likewise, "44 per cent of Canadians would like a home with more space for personal amenities, such as a pool, balcony or a large yard." See "Canadian housing market expected to remain active for the remainder of 2020 due to pent-up demand and low inventory levels, says RE/MAX brokers and agents," August 20, 2020, RE/MAX Canada, https://www.newswire.ca/news-releases/canadian-housing-market-expected-to-remain-active-for-the-remainder-of-2020-due-to-pent-up-demand-and-low-inventory-levels-says-re-max-brokers-and-agents-860775618.html; For example, while Toronto's housing market saw a brief pause in March, it was followed by a surge in home sales outside of the city centre. Seven municipalities, which were on average 86km away from Toronto, saw the biggest growth in sales, up 40 per cent year-over-year. See: Matthew Bingley, "Coronavirus: Home sales surge outside of Toronto as residents seek more rural life," July 22, 2020, Global News, https://globalnews.ca/news/7207180/coronavirus-toronto-ontario-real-estate-covid-19/; "Urban sprawl continues, with Toronto and Montréal both experiencing record-high population losses to surrounding areas." See "Canada's population estimates: Subprovincial areas, July 1, 2020," January 14th, 2021, Statistics Canada, https://www150.statcan.gc.ca/n1/daily-quotidien/210114/dq210114a-eng.htm?HPA=1

Our energy system is a part of everything we do and, in this way, is an exceptionally personal and political topic. Participants noted that for many communities in Canada—in particular Indigenous communities and communities that face energy poverty—changing the energy system is not just about environmental impacts but also self-determination. Energy plays a role in our personal, work, and school lives and enables us to heat and cool our homes and workspaces, and travel from place to place. For communities that experience energy poverty, control and ownership over these crucial aspects of life is threatened; decentralized, community owned and led energy projects provide a way to take back that control. Participants highlighted work by Indigenous Clean Energy and the many prominent examples of Indigenous-led clean energy projects where Indigenous Communities are becoming owners and small energy producers for everything from biomass and biofuels to wind, hydro, and solar.[25] Another participant highlighted the Gull Bay First Nation Microgrid Project, a renewable energy microgrid project that uses solar power to offset diesel use. When the sun shines and the solar panels are available for use, the local diesel generators switch off, eliminating the need for approximately 110,000 litres of diesel, which reduces the community's diesel use by 25% per year.[26] In communities where local energy production is not yet possible, other measures like demand-side efficiency tools and energy efficiency retrofits can also provide positive health outcomes and local economic development opportunities. Government policies and programs can provide essential support—especially funding arrangements that reduce the overall risk associated with a project.[27] Individuals and communities are key players in Canada's energy system, but to make impactful choices and create change, they need to be set up to succeed. Overall, participants agreed that strong action by individuals and communities is crucial to meaningful change; however, these players need access to important resources first.

Outside of grants, loans, and other government funding, green bonds are an important financial instrument. For example, SolarShare, a Canadian renewable energy co-op, offers individuals the ability to invest in solar energy bonds—to date, over 1,900 Ontario residents have invested more than $60 million in solar energy projects across Ontario.[28] Individuals and communities need access to important information about their local energy systems, their personal energy use, and the steps they can take to reduce their environmental impact and make their energy use more sustainable. Along with getting the right information, individuals and communities need to be environmentally and energy literate: they need to be able to understand the information they are provided and be able to put it to use. It is often said that patients are the most underutilized resource in healthcare, and arguably, the same can be said for utility customers.

25 There are at least 197 medium-to-large renewable energy generating projects with Indigenous involvement, and 1,700 to 2,100 micro or small renewable energy systems now in operation. "Indigenous communities…leaders in clean energy projects," 2021, Indigenous Clean Energy, https://indigenouscleanenergy.com/ice-projects/

26 "Canada's Game Changer: Off-grid diesel reduction to energy sovereignty," 2021, Kiashke Zaaging Anishinaabek; Gull Bay First Nation, http://www.gullbayfirstnation.com/mashkawiziiwin-energy/

27 Cara Sanders and Askii Environmental, "Accelerating Transition: Economic Impacts of Indigenous Leadership in Catalyzing the Transition to a Clean Energy Future Across Canada," Page 5, June 2020, Indigenous Clean Energy, https://icenet.work/attachment?file=HGQf2DFTWWhIlc6jcRtUCg%3D%3D

28 "SolarShare: Invest in brighter future," 2021, SolarShare, https://www.solarbonds.ca/

Demand-side measures that provide customers with access to detailed information about their energy use create an opportunity for behavioural adjustment. Coupled with AI, demand-side solutions can even provide customers with suggestions to curtail their energy use and/or reduce demand in peak hours.

Readily available models and/or blueprints of leading examples are important in inspiring more communities to act. As one participant noted, systemic change happens through word of mouth and through demonstrating what is possible. For example, participants discussed the success that Vancouver had with alternative transport, green space, and low-emission buildings over the course of its Greenest City Initiative.[29] The city has reduced people's dependency on cars and increased the number of community gardens: it is now a leading city in North America in terms of the number of people who walk, bike, and use public transit in place of cars, and is consistently among the top cities in the world for green space. Participants pointed out that across Canada, there is a need to redesign cities to make more public green space available and make communities less dependent on cars by providing essential services within two to three kilometres of people's homes. Another participant highlighted the Lac-Mégantic Microgrid project, Hydro Québec's first microgrid, which involves solar panels, energy storage units, and energy management tools.[30]

Participants agreed that the "hub model" for information sharing can provide a meaningful and coordinated way to disseminate "success stories on the ground" and make individual best practices and lessons-learned openly available. The hub model uses community-based, localized hubs to facilitate grassroots innovation at the community level through mentoring and support programs. Participants noted that the hub model is currently in use in Ontario under the Green Economy Canada Green Economy Hubs program[31] and throughout Canada by Indigenous Clean Energy; the hub model is also a core part of the Government of Canada's Hydrogen Strategy.[32]

29 "Vancouver planned to be the greenest city in the world by 2020. It probably isn't.," January 3rd, 2020, CBC News, https://www.cbc.ca/news/canada/british-columbia/vancouver-planned-to-be-the-greenest-city-in-the-world-by-2020-it-probably-isn-t-1.5414502

30 "Québec's first microgrid," 2021, Hydro Québec, https://www.hydroquebec.com/microgrid-lac-megantic/

31 "Green Economy Hubs," 2020, Green Economy Canada, https://greeneconomy.ca/green-economy-hubs/

32 "Hydrogen Strategy for Canada: Seizing Canada's Hydrogen Opportunity," December 2020, NRCAN, https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/environment/hydrogen/NRCan_Hydrogen-Strategy-Canada-na-en-v3.pdf

Conclusion

Individuals, communities, and private and public sector actors have to be aligned in order to tackle the significant challenge of climate change. We must first decide what we want “prosperity” to include in Canada and then marshal policy levers and innovation in coordination with individual and community action to enact our energy transition. For example, it needs to be cheaper and more accessible for an individual to take alternative transport than drive a car; more affordable to purchase an energy efficient or zero-emissions vehicle than it is to buy a truck; and more cost effective for an individual to purchase solar panels or install a heat pump in their home than it is to continue using a gas furnace. Government can support consumers and industry by making the transition to renewable energy easier: small renewable and cleantech companies benefit, as do larger energy sector companies, if everyone has better incentives to invest in an energy transition. Without the right policy levers to make environmentally conscious decision-making simpler and more cost effective, action will continue to be out of reach for many Canadians: as one participant put it, it is a huge privilege to be able to make a low carbon choice for its own sake.

ICTC’s second roundtable in a series of five Smart City Policy Roundtables took place in December 2020. The topic of Smart Energy and Environment engaged thought leaders from across Canada to produce this brief. The next ICTC roundtable will take place in February 2021 on the theme of Smart Mobility.