

Halton Hills Low-Carbon Transition Strategy

Net Zero x 2030

DRAFT

October 2021

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Executive Summary

In response to the climate emergency, the Town of Halton Hills set a target to achieve **net-zero greenhouse gas emissions (GHGs) by 2030**. We are the first municipality in Canada to do so, placing Halton Hills on par with global climate leaders like Glasgow, Adelaide, Glasgow, Bristol, and Copenhagen.

This Low-Carbon Transition Strategy (LCTS) is our response to the climate emergency. Designed with input from the public and by a committee with representation from across the community (the Multi-Stakeholder Governance Committee or MSGC), the Strategy lays out a plan for how the public, businesses, and the Town can work together to meet Halton Hills' climate goals and improve local quality of life. Together, we can create a more prosperous, equitable, healthy community.

Within a decade the LCTS envisions streets designed to accommodate cyclists, pedestrians, e-buses, and electric vehicles (EVs). Homes, shops, and industrial facilities will be drastically more energy efficient and heated primarily by renewable electricity from solar panels installed throughout Halton Hills. Instead of decomposing in landfills, food and other organic waste will be diverted to a composting facility or used to create renewable natural gas. And there will be 450,000 more trees.

As we make these changes to reduce emissions, our air will become cleaner, we'll have more greenspaces to enjoy, and we'll reduce our energy bills. Our economy will also grow as investments in green construction, renewable energy, and sustainable transportation create local jobs.

We are a small community with big ambition. The LCTS is our data-based and community-informed pathway to achieve our goals.

Why Net Zero by 2030?

Halton Hills' commitment is aligned with the current science on the climate crisis: the most recent report released by the UN Intergovernmental Panel on Climate Change (IPCC) in August 2021 provides an update on the physical science. The state of global warming is worse than it was expected to be when the last report was released eight years ago. We have now surpassed 1°C of global warming. This means that the target of net zero by 2050 and a 45% reduction from 2005 levels by 2030, which was outlined in the 2018 UN Special Report on Global Warming of 1.5°C, is no longer sufficient to decrease the likelihood of catastrophic climate change. The IPCC will be releasing a new report in early 2022 identifying appropriate mitigation pathways.

The Town's target is also **aligned with international UN principles** of equal but differentiated responsibility, meaning that those who are responsible for more GHGs per capita—currently and historically—and have more resources per capita than others, have a responsibility to rapidly address a larger share of the global carbon budget.

The LCTS is an opportunity. By most indicators, the energy system is in transition away from fossil fuels. Halton Hills' commitment to decarbonize ahead of the curve will enable us to **capitalize on new economic opportunities**, avoid projected financial losses, and ensure sustainable economic growth.

Growing Sustainably

The Town of Halton Hills is planning for a 45% increase in population between 2016 and 2030. The Town will ensure this growth supports a sustainable transition to a low-carbon economy. Anything our community builds today is likely to still be in place in 2030 and beyond. The LCTS outlines how new homes, businesses, and transportation infrastructure can be developed in alignment with a net-zero-by-2030 future. Starting as soon as possible, all new buildings need to be heated with renewable electricity and residents will need to have access to EV chargers, shared e-mobility services, and cycling paths.

The LCTS is also a community investment plan. Its implementation is projected to create local jobs, reduce household energy bills by nearly 50%, and develop local energy projects, all of which will help bring and keep money in the community. This investment plan will attract new businesses and residents and ensure Halton Hills is not just resilient to the economic transition, but thrives in it.

Community Driven

Council passed the Town's ambitious target unanimously in May 2019, acknowledging the strong support for bold action in the community. Since then, the community has been deeply engaged in developing the LCTS.

The Town brought together a diverse group of stakeholders to form the LCTS Multi-Stakeholder Governance Committee (MSGC) via an open-call for applicants. The 24-member group included residents, academics, utilities, youth, industry, environmental groups, and Town staff. The MSGC attended multiple workshops to learn about the Town's energy use and emissions profile and climate action best practices. They then provided input on what kinds of climate actions would be appropriate for Halton Hills. They also provided insight on a systematic implementation program to ensure the Strategy's success.

The LCTS was informed, and will continue to be overseen, by the community.

The Net-Zero Pathway

By implementing an aggressive set of actions across the buildings, transportation, waste, and land use sectors, the analysis completed for the LCTS shows our community can reduce our emissions by nearly 75% by 2030. Because of significant projected population growth, this reduction is much more significant on a per person basis: about an 82% decrease. Halton Hills is a small place in the global context. But this effort is an important symbol. The community has committed to do its part, and in doing so will position itself as a climate leader.

In less than a decade, a Halton Hills resident can reduce their average annual GHG emissions from 7.2 tonnes to 1.3 tonnes of carbon dioxide equivalent (CO₂e). Community-wide, this means 457 kilotonnes (kt) in 2016 to 120 kt in 2030.

The remaining emissions in 2030 are primarily from combustion engine vehicles purchased today and in the near future. They are expected to be phased out as they naturally reach their end of life by around 2040. It is difficult to stop these remaining emissions without removing vehicles from the road before their end of life or introducing policies to prevent residents from owning combustion engine vehicles, which the LCTS does not contemplate. To reduce these remaining 120 kt CO₂e in 2030, and achieve net-zero, the LCTS includes the purchase of offsets⁰. As new technologies and options become available, additional carbon reduction solutions can be incorporated into future iterations of the Strategy, reducing the need for offsets.

The Town's pathway to net zero is made up of four main action areas:

1. **Low-carbon mobility:** Enabling travelling by foot, bicycle, emissions-free transit, or electric vehicles.
2. **Energy efficiency and green development:** New and existing buildings are significantly more energy efficient and are powered by renewable energy, including solar panels on roofs and geothermal heating systems for sufficiently dense new developments;
3. **Local renewable energy:** Replace fossil fuel energy with local renewable electricity and renewable natural gas; and
4. **Natural assets:** Protect and expand the town's natural carbon sinks, greenspaces and healthy soil, to offset some of the remaining emissions.

These actions attract new investments, create jobs, and save money, they also result in social and environmental co-benefits, most notably: reduced air pollution, more active residents, increased biodiversity, and increased resilience to extreme weather events. The result is a better quality of life for the people of Halton Hills.

Turning to Action

Achieving net zero by 2030 will require acting immediately, with a nimble and ambitious approach that includes planning while doing and a risk management strategy that includes learning from mistakes while moving forward. This is something the Town and the Multi-Stakeholder Governance Committee (MSGC) have already begun to do.

Achieving net zero by 2030 will also require action from the entire community. The behavioural change needed to accomplish this will be significant, and will be accomplished through a combination of smart program design and a public education campaign.

The LCTS will be guided by the following principles:

- Collaboration and innovation,
- Equity, and
- Community oversight.

These principles have been developed based on a combination of input from the Town and stakeholders as well as best practices. They are expanded upon in Part III of the report.

To learn more and get involved, visit **haltonhills.ca/climatechange**.

Acronyms

ASHP	air source heat pump
BAU	business as usual
CO2e	carbon dioxide equivalent
EUI	energy use intensity
EV	electric vehicle
GHG	greenhouse gas
GJ	gigajoule
kt	kilotonnes
IPCC	Intergovernmental Panel on Climate Change
LCTS	Low-Carbon Transition Strategy
MAC	marginal abatement cost
MW	mega watt
MSGC	Multi-Stakeholder Governance Committee
PV	photovoltaic
RNG	renewable natural gas
t	tonnes
UN	United Nations
VKT	vehicle kilometres travelled

Land Acknowledgment

The Town of Halton Hills is located on the Treaty Lands and Territory of the Mississaugas of the Credit.

Acknowledgement

Table 1. Members of the LCTS Multi-Stakeholder Governance Committee (MSGC).

Residents-at-Large	Evelyn Lundhill Jean Leckie Colin Royce Daniel Poirier Roscoe Petkovic	Local Utilities	Carol Suter/ Brian Lennie, Enbridge Chris Hale, Halton Hills Hydro
Local Conservation Authority	Jason Igras, Credit Valley Conservation	Agriculture/ Academia	Ralph Martin, retired professor, University of Guelph
Local Business and Industry	Dino Degliannis, Chamber of Commerce Robert Maxim Florent Leffevre-Schlick Mike Carter, Renewable Energy Developer	Town of Halton Hills	Dharmen Dhaliah, Climate Change and Asset Management Mike Dean, Climate Change and Asset Management Ivan Drewnitski, Transportation Rob Stribbell, Planning Graham Lowe, Economic Development Meagan Cooper, Communications
Local Environmental Groups	Dr. Monika Caemmerer, Halton Hills Climate Action Lisa Kohler, Halton Environmental Network	Youth	Faisal Shahbaz
Local Institutions	Suzanne Burwell, Halton District School Board	Building/ Development Industry	Marina Huissoon, Green Propeller

BOX: Halton Hills Climate Emergency Delegates

Several delegates spoke in support of the May 6, 2019 motion to declare a climate emergency and set a target of net zero by 2030. The motion then passed unanimously. The following are some highlights from those speeches:

“I want to ask our leaders a serious question: Do I deserve a future? When you were my age, did you think you deserve the life you enjoy now? [...] I believe that we can slow and then stop climate change. [...] We have electric cars, we have buses, we have wind turbines, we have more and more people walking [...] we have smart homes saving energy and smart people helping us. In the future I want to see green forests, clean lakes, comfortable summers and winters [...] I want a future in which there is food for people and animals. [...] I want a future where we live within our environmental limits. We have the power to make a difference [...] All we have to do is *make* the difference.”

-Spencer Lippa, 12 years old, youngest member of the Green Party of Canada

“[...] If we don't have healthy communities, we really don't have a lot. We know that climate change will affect the health of our communities in various ways. One of the top ways it affects it is with air pollution. We need concrete action on reduction of air pollution, that includes encouraging people to walk, making our communities walkable, encouraging people to bike, making safe separated bike lanes throughout the community so that people feel safe while they are biking, and encouraging the use of things like electric cars. And I think all of these things can be addressed through good policy.”

-Dr. Lesley Barron, general surgeon, Georgetown

“[...] We know we need action. Our climate is changing, it's fast-paced, it's causing widespread profound consequences for all living organisms. [...] The number one health concern for Canadians is climate change. The number one concern. So, every day I hear from our community, the urgency, the challenge, the need for change. We all do need to lean in. We have no planet B. This is Halton Hills' opportunity. It's your opportunity to declare an emergency, have dialogue, have tangible actions that will really lead to transformative change. [...]”

-Lisa Kohler, Executive Director Halton Environmental Network

“Friday's climate action rally here in Georgetown was a big success. We asked people to write on these ribbons what they love and hope never to lose to climate chaos. Some of the things they wrote: songbirds, butterflies, the crops that sustain us, coral reefs, the sounds, sights, and smells in our woods, white pines, loon calls, frozen ponds and backyard rinks. My grandchildren's future, my future. All of these are in peril. [...] We can stave off climate chaos with a rapid switch to green energy and many other initiatives. I support this resolution and all the recommended actions within it.”

-Janet Duval, Halton Hills Climate Action Rally

Letter from the Mayor

Dear Halton Hills residents:

I am proud to introduce this Low-Carbon Transition Strategy: a pathway towards our ambitious target of net-zero greenhouse gas (GHG) emissions by 2030. This strategy stands alongside our Climate Change Adaptation Plan to form our community's response to the climate emergency.

This decarbonization strategy represents a major transition for our community, one that will help make all our residents and businesses healthier, happier, and more prosperous—all while maintaining our small-Town feel. This pathway puts us on the leading edge of the global net-zero transition.

Over a year in the making, the following pages contain a decarbonization strategy that leverages our Town's strengths to address the greatest local GHG emissions sources: our dependence on gasoline and diesel guzzling cars and trucks; our energy inefficient homes and businesses; and our reliance on natural gas for heating. It addresses these challenges with our greatest strengths: our local skilled labour and businesses; our abundant renewable energy sources and natural spaces; and our passionate and engaged community. The result is a community investment plan that will create local jobs in green home construction, renewable energy, transit and active transportation infrastructure, and electric vehicles. This strategy will also help keep money in residents' pockets by lowering household energy bills.

Many individuals contributed to develop this strategy, from Town staff, consultants, local utilities, residents (young and old), environmental groups, institutions, and businesses. We made our best efforts to meaningfully engage with these folks, educating them about the challenges we are facing, and listening to their concerns and suggestions.

The release of this strategy is just the beginning. Now it is time for action. From the Town to the broader community, we will act, we will monitor, we will report, and we will improve.

You wanted our community to do its part to respond to the climate emergency, by working towards an ambitious net-zero by 2030 target—this strategy sets a pathway to deliver.

Sincerely,



Rick Bonnette
Mayor, Town of Halton Hills



BOX: How to Read This Report

This report summarizes the Town’s Low-Carbon Transition Strategy (LCTS).

Part I sets the scene, including information on the 2030 target, the plan’s overall projected economic impacts, and the process that was used to develop the plan.

Part II lays out the net-zero pathway, including the overall energy and emissions shift from business as usual to net zero, and a closer look at each of the Strategy’s four main actions—related to transportation, buildings, renewable energy, and natural carbon sequestration—their costs and benefits, and key implementation strategies.

Part III turns to LCTS implementation. It includes a discussion of the types of collaboration and innovation that will be needed to bring its big moves to life, as well as the oversight that will be needed to keep it on track and ensure accountability. This section highlights the need for equitable program design to ensure the significant investments are deployed in a manner that benefits the entire community.

The **appendices** contain the technical analysis that underpins the LCTS. These are referenced throughout Parts I-III.

Part I: Setting the Scene

An Ambitious Target

The climate crisis demands bold and swift action to protect our environment—and the people, animals, plants, and economy that rely on it. By declaring a climate crisis in 2019, the Town of Halton Hills committed to both addressing the challenge and seizing the opportunity of climate change. The Town set an ambitious target: net-zero greenhouse gas (GHG) emissions by 2030. This target means that, starting as soon as possible, the Town will ensure its investments are aligned with the global shift to net zero emissions.

By setting a target of net zero by 2030, Halton Hills joins the ranks of a leading group of communities including Copenhagen, Melbourne, Bristol, Ithaca (New York), Glasgow, and Melbourne. This target goes beyond the Federal target of net-zero by 2050, which, until quite recently, was considered the minimum global average reduction needed to avoid catastrophic climate change.¹

It is a prescient target; one that acknowledges how quickly climate science is evolving. Indeed, in August 2021, the UN IPCC released new science that indicates the climate crisis is more dire and the global carbon budget is smaller than previously understood.² Each new projection is consistently worse than the last.

It is an equitable target based on the idea that communities that have relatively more resources and emit more per person, have a responsibility to reduce their emissions faster than the global average.

It is an optimistic target. It reflects a community that is confident in its growth and wants to harness this new money to invest in a sustainable and profitable future.

The Low-Carbon Transition Strategy (LCTS) sets a course for Halton Hills to work towards its ambitious target and decarbonize. It complements the Town's efforts to improve the community's physical resilience to increasingly extreme weather conditions (via the Town's Climate Change Adaptation Plan). Together, these climate mitigation and adaptation plans form the Town's Low-Carbon Resilience Framework (see Figure 1).

¹ IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.

² IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J. B. R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press.

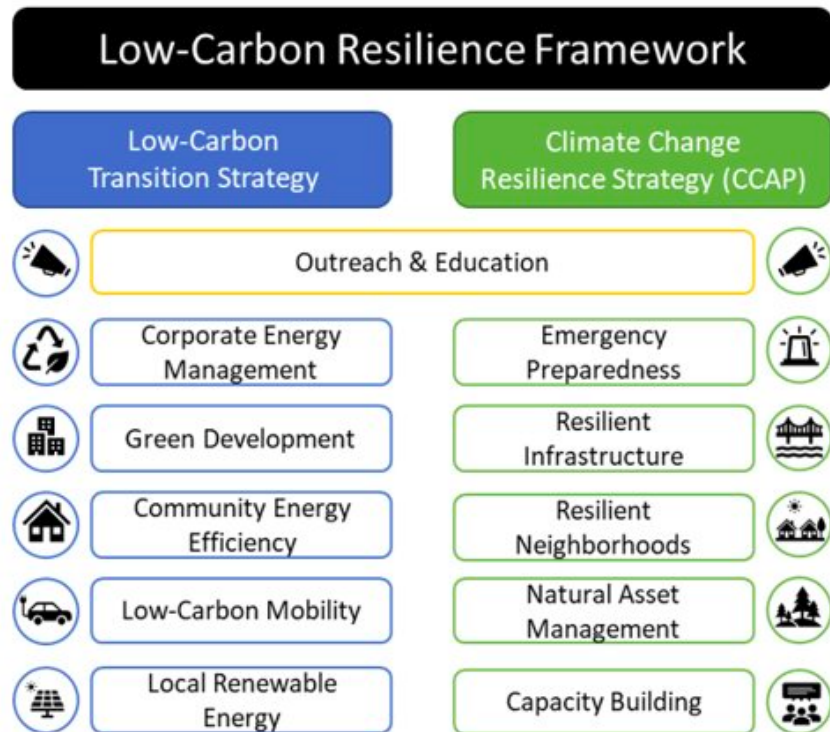


Figure 1. The structure of the Town's Low-Carbon Resilience Framework.

BOX: A Science and Equity-Based Target

Halton Hills' commitment is **aligned with current science**: the most recent report released by the UN Intergovernmental Panel on Climate Change (IPCC) in August 2021 provides an update on the physical science. The state of global warming is worse than it was expected to be when the last report was released 8 years ago. We have now surpassed 1°C of global warming. This means that the target of net zero by 2050 and a 45% reduction from 2005 levels by 2030, which was outlined in the 2018 UN Special Report on Global Warming of 1.5°C, is no longer sufficient to decrease the likelihood of catastrophic climate change. The IPCC will be releasing a new report in early 2022 identifying new mitigation pathways.

The Town's target is also **aligned with international UN principles** of equal but differentiated responsibility, meaning that those who are responsible for more GHGs per capita—currently and historically—and have more resources per capita than others, have a responsibility to rapidly address a larger share of the global carbon budget. Halton Hills' commitment to decarbonize ahead of the curve will enable the community to **capitalize on new economic opportunities**, avoid projected financial losses, and ensure sustainable economic growth.

Co-Benefits: Economic, Social, and Environmental

The LCTS is a plan that will enable the Town to capture many co-benefits: positive economic, social, and environmental benefits of actions that reduce GHG emissions. Some of the countless associated co-benefits are outlined below.

Economic Benefits

The Strategy will enable us to participate in the emerging and growing net-zero economy. The financial and economic analysis of the LCTS versus business-as-usual demonstrates that decarbonization has significant financial benefits: our community will spend less on energy, pay lower federal carbon taxes, and see thousands of new job opportunities.

For example, the proposed mass deep residential and commercial retrofit program—to increase energy efficiency and reduce related emissions—is projected to produce about 1,000 jobs (9,000 person years of employment between 2022 and 2030) while the proposed solar energy developments are projected to produce nearly 350 jobs (3,150 person years of employment between 2022 and 2030).

Nearly \$2 billion dollars in investment—or about \$218 million a year over 9 years—is required to implement the Strategy. This investment has an estimated net present value of just over \$850 million, or a 43% return on investment. To put this into perspective, the LCTS contemplates an annual investment program equivalent to approximately 10% of the Town’s 2020 gross domestic product.³ It is not just the Town that is expected to make investments (and receive the benefits); local businesses, residents, and other levels of government will all have important roles. For example, local businesses can invest in retrofits and develop solar projects. Residents will be able to participate in retrofit programs and choose to walk, cycle, take transit, or drive EVs to reduce their transportation emissions. Other levels of government will need to fund key programs and establish supportive policies.

BOX: Investing in the LCTS

Decarbonising Halton Hills requires major investments, by a variety of players. In total, nearly \$2 billion over 9 years. When broken down by action and entity, this large number is much easier to swallow. Each electric vehicle purchased today represents at least \$10,000 of this investment (the incremental cost over a gasoline car). If 2,000 cars are purchased by households, for example, that represents \$20 million of investment. These are investments that can often pay for themselves through fuel and maintenance savings over their lifetimes. Each household that is retrofitted represents an investment of \$60,000 (the estimated incremental cost over typical spending on energy efficiency). If 500 homes are retrofitted, the investment totals an estimated \$30 million over the baseline. Again, these investments can potentially pay for themselves through energy savings and then through property value increases. These

³ In 2020, the gross domestic product of the Town of Halton Hills was \$2.24 billion. (View the 2021 Halton Hills Budget and Business Plan, Online at: www.haltonhills.ca/en/your-government/budgets.aspx.)

investments will be taken by a wide range of actors and most will generate returns. While the Town will lead some of these investments, in other areas, it will primarily work to remove barriers and build capacity.

The investments outlined in the LCTS will create more jobs and attract new investments, while reducing household energy bills by nearly 50%. The proposed community-wide investments in local renewable energy will build on existing experience and expertise; for example, the Town's successful 2017-2018 rooftop solar installations at 3 facilities that together generate over 1 MW a year (enough to power between 150-200 homes per year). Additional community-wide investments in renewable energy will help attract new investment and retain money in the local economy. Currently almost all energy consumed in the Town of Halton Hills is produced and owned well beyond the Town boundary. This plan will attract new businesses and residents, and ensure the community is resilient and prepared to thrive in the coming economic transition.

Improved Public Health

The social benefits of the LCTS include improved public health. Residents will breathe cleaner air as tailpipe emissions decrease and more trees are planted. The public will also become more physically active as walking and cycling infrastructure improves and more people walk and bike, instead of drive, to their destinations.

Improvements in fuel-efficiency, increased use of public transport, fewer diesel engines, and electrification of transport will all contribute to improved air quality and better health outcomes. Traffic-related air pollution at relatively low concentrations in Ontario was associated with increased mortality from cardiovascular disease,⁴ and, more generally, with the increased prevalence of asthma and allergic diseases.⁵ An assessment for Toronto found that living near major roadways and highways increased the risk of heart disease.⁶ Children living near major highways are at higher risk of developing asthma and reduced lung function.⁷

⁴ Chen, H., Goldberg, M. S., Burnett, R. T., Jerrett, M., Wheeler, A. J., & Villeneuve, P. J. (2013). Long-term exposure to traffic-related air pollution and cardiovascular mortality. *Epidemiology*, 24(1), 35–43.

⁵ Bowatte, G., Lodge, C., et al. (2015). The influence of childhood traffic-related air pollution exposure on asthma, allergy and sensitization: a systematic review and a meta-analysis of birth cohort studies. *Allergy*, 70(3), 245–256.

⁶ Beckerman, B. S., Jerrett, M., Finkelstein, M., Kanaroglou, P., Brook, J. R., Arain, M. A., ... Chapman, K. (2012). The association between chronic exposure to traffic-related air pollution and ischemic heart disease. *Journal of Toxicology and Environmental Health. Part A*, 75(7), 402–411.

⁷ Brugge, D., Durant, J. L., & Rioux, C. (2007). Near-highway pollutants in motor vehicle exhaust: A review of epidemiologic evidence of cardiac and pulmonary health risks. *Environmental Health*, 6, 23.

Studies in Copenhagen⁸ and Shanghai⁹ have shown that mortality rates are 30-40% lower among those who cycle compared to those who do not use active transport or get equivalent amounts of leisure time exercise. A 19% reduction in mortality risk is shown to occur with 30 minutes of daily moderate-intensity activity, 5 days per week. Children who walk or bike to school are fitter than those who travel by car or bus, with 30% improvements in boys, and seven times in girls.¹⁰

Greater Equity

Although the Town of Halton Hills is more affluent than the national average, the Town still has some low-income and under-employed residents. As a part of the LCTS, the Town commits to improving social equity by ensuring climate action implementation is designed in a manner that ensures the entire community has opportunities to participate in reducing emissions. For example, the LCTS includes a commitment to enable low-income residents to retrofit their homes, which tend to be older and inefficient, to decrease their energy consumption and their energy bills.

Ecological Health and Resilience

Finally, in terms of environmental benefits, more trees and healthier soil, will all contribute to increased biodiversity and resilience to extreme weather events in the Town.

More natural space provides habitat for animals, insects, and plants. All of which are necessary for a healthy, stable ecosystem. These green spaces also provide numerous valuable ecological services to communities. For example, natural places provide stormwater management services, which helps minimize costly and dangerous flooding as well as the energy-intensity of local wastewater treatment systems. Green spaces also help moderate extreme heat events, contributing to greater comfort for creatures and residents in outdoor spaces, and for home and building occupants.

For additional financial and economic analysis results of the LCTS, including key assumptions, see Appendix E.

The LCTS Development Process

The Town developed the LCTS over more than a year between 2020 and 2021 with the help of consultants at Sustainability Solutions Group, who designed and led interrelated community engagement and technical modelling processes (see Figure 2). The interaction between these two

⁸ Andersen, L. B., Schnohr, P., Schroll, M., & Hein, H. O. (2000). All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. *Archives of Internal Medicine*, 160(11), 1621–1628.

⁹ Matthews, C. E., Jurj, A. L., Shu, X.-O., Li, H.-L., Yang, G., Li, Q., ... Zheng, W. (2007). Influence of exercise, walking, cycling, and overall nonexercise physical activity on mortality in Chinese women. *American Journal of Epidemiology*, 165(12), 1343–1350. <https://doi.org/10.1093/aje/kwm088>

¹⁰ Voss, C., & Sandercock, G. (2010). Aerobic fitness and mode of travel to school in English schoolchildren. *Medicine and Science in Sports and Exercise*, 42(2), 281–287. <https://doi.org/10.1249/MSS.0b013e3181b11bdc>

processes helped ensure that the plan is achievable and evidence-based while being rooted in the local context and responding to community concerns.

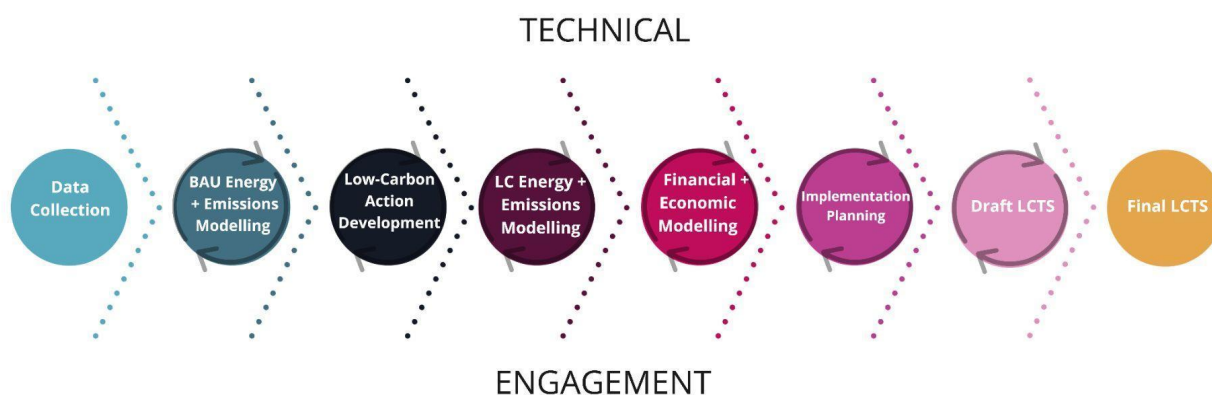


Figure 2. An overview of the LCTS development process.

The technical modelling process began with extensive data gathering, which informed the energy and emissions model for the Town.

The engagement process began with research on community preferences for engagement styles, followed by the formation of a diverse stakeholder advisory committee (the MSGC). A timeline of key engagement events is provided in Figure 3.

The 24-member MSGC was selected by the Town from an open call for applicants, based on the need for diverse stakeholder representation and relevant experience. Its membership consisted of Town residents, youth, utility representatives, Town staff, the business community, local institutions, and environmental non-profits (a full list is provided in Table 1). Their mandate was to provide advice on the LCTS development process; the ultimate decision-maker was and is Council.

The MSGC and its data and implementation/governance subcommittees were key sources of oversight and input into the LCTS. Members participated in nearly a dozen hours of meetings, in which they learned about the Town's energy and GHG emissions in a business-as-usual scenario, as well as the scale of action that would be needed to decarbonize. During these meetings, members had an opportunity to hear from experts, ask questions, share their experiences, and participate in brainstorming sessions. In addition, members were asked to prepare for meetings. The MSGC helped shape the focus of the LCTS, the scale and depth of its actions, and the content of its Implementation Framework.

Drawing on input from the MSGC, combined with research on best practices, the Town and consulting team identified a range of actions Halton Hills could take to reduce its emissions. These low-carbon actions were then evaluated in a financial model to compare the level of investment required for the net-zero scenario versus business-as-usual. These draft technical results were presented to the MSGC who helped refine them with more context-specific data, for example information from their:

- organizations (e.g., current and projected energy costs, fleet decarbonization program),

- research (e.g., soil management best practices), and
- individual household experience (e.g., costs to install heat pumps and EV chargers).

The general public were also provided with opportunities to learn about the plan and provide input early on via: a dedicated LCTS page on the Town's website, social media, a Let's Talk Halton Hills public engagement portal, a virtual Town Hall, and a survey.

The MSGC and the public provided critical input on potential local partners, potential expansion or development of policies and programs, and sources of investment. Answers from an implementation focused public survey are featured throughout this report. This helped inform the LCTS' near-term implementation strategy.

The feedback received through community engagement sessions was critical to shaping this Strategy.

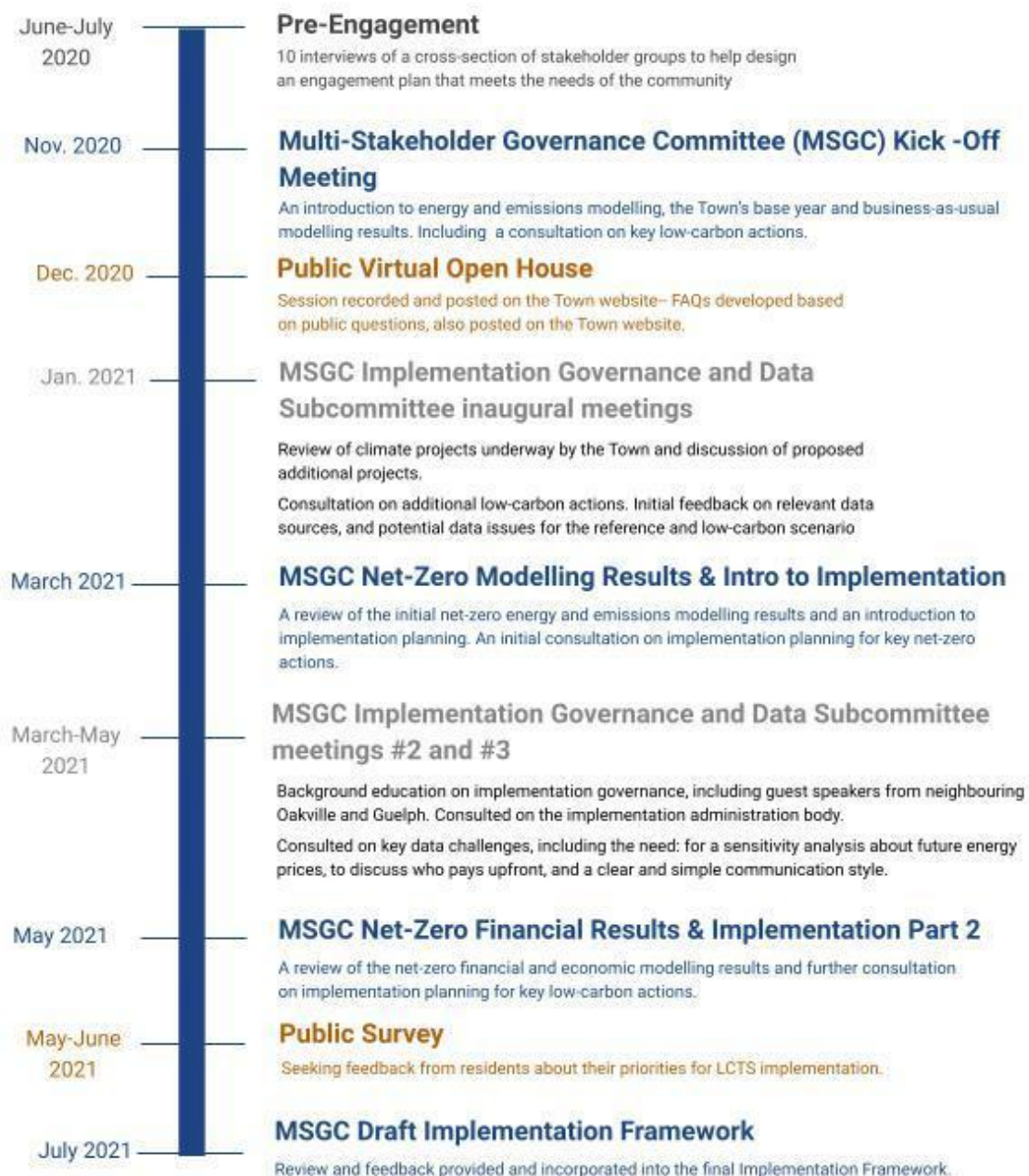


Figure 3. Timeline of key LCTS engagement events.

Planning While Doing

The MSGC also applied a “planning while doing” philosophy. Mindful that there is no time to waste, they set to work on climate mitigation initiatives, including:

- Identifying locations and utility processes for developing local large-scale solar installations;
- Planning an e-bike sharing pilot to help residents tackle the Town’s namesake hills;

- Setting up the Town’s first EV Day to help educate residents and the local automotive industry about EV options;
- Working with local academic institutions to provide training and guidance to local businesses on reducing energy consumption and GHG emissions; and
- Designing an LCTS oversight and implementation body.

Residents, local businesses, utilities, and Town staff are working hand-in-hand to develop and implement these projects.

Modelling as a Planning Tool

Along with the critical engagement input described above, the LCTS was informed by an analysis of Halton Hills’ current and projected energy use and emissions in a business-as-usual or “reference” scenario. This scenario was modelled using the CityInSight energy, emissions, and finances model.

BOX: The CityInSight Energy, Emissions, and Finances Model

CityInSight is an energy, GHG emissions, and finance model developed by Sustainability Solutions Group and whatIf? Technologies. The model enables detailed bottom-up accounting of a community’s energy use and GHG emissions. This means that the model accounts not just for overall energy use and GHG emissions totals, but also ensures these totals are driven by actual cars and buildings in space.

From the stocks of vehicles and buildings, CityInSight traces the flows and transformations of energy from sources through energy currencies (e.g., gasoline, electricity) to end uses (e.g., personal vehicle use, space heating) to energy costs and to GHG emissions. A more limited analysis is undertaken for the stock of organic waste produced per person, with an emissions factor applied based on the applicable waste management system. These flows evolve on the basis of current and projected population, land use, and/or technologies.

This modelling process not only allows the model to capture interactions between different actions, it also allows for consideration of the impact of land-use patterns and urban form on energy use and emissions production.

Finally, CityInSight incorporates a full financial analysis of costs related to energy (expenditures on energy) and emissions (carbon pricing), as well as operating and capital costs for policies, strategies and actions. It allows for the generation of marginal abatement curves to illustrate the cost and/or savings of policies, strategies, and actions.

Drawing on data about local demographics, buildings, transportation, land use, industry, water and wastewater, and waste, the analysis team used the model to create a picture of the Town’s energy use and GHG emissions in space from stocks (e.g., cars, furnaces, waste), which change over time (based on

changes in population, jobs, and land-use patterns). This reference scenario was critical to understanding the type and scale of actions necessary for the town to decarbonize.

Emissions reduction actions were input into the model to test their impact on energy use and emissions relative to the reference scenario and identify when and in what order in which actions could be implemented to minimize costs and maximize benefits. Through this process, the consulting team developed a net-zero scenario consisting of an optimal bundle of actions—selected based on technical analysis and community input—that informed the LCTS.

The model also helped assess the financial impacts of the net-zero scenario relative to the reference scenario, including the costs of and returns on investments, maintenance of equipment, household and business energy bills, and how much employment would be created by climate actions.

Critically, the scenarios generated by the model are not a prediction, but plausible evidence-based projections on how the future may evolve based on data and assumptions about the key drivers of emissions and critical trends (e.g., rate of technological change, energy prices). Though imperfect, modelling is an important tool to help communities understand the type and scale of action necessary to drive major emissions reductions. In this case, the model helped the Town and MSGC identify the big moves that are necessary for a net-zero transition.

The LCTS is intended to be refined every five years based on updated modelling, annual program reporting on key performance metrics, lessons learned from implementation, updated GHG inventories, best practices, and new technologies. This 5-year review and updating process should not prevent interim piloting of new GHG mitigation policies that may improve LCTS program implementation or address the remaining carbon gap. Any interim piloting will also be included in the 5-year review process. This formal review and updating process will be subject to stakeholder consultation and will be transparent.

For additional information on the technical modeling process, its inputs, and assumptions, please review Appendix F.

Part II: The Plan

From BAU to Net-Zero

In 2016, Halton Hills generated 457 kt CO₂e of greenhouse gas emissions. This translates to about 7.2 tCO₂e per person. Almost half of these emissions are due to personal and commercial vehicles, followed by residential and commercial buildings, and then industrial processes. Despite many positive regulations and market trends, it is projected that in a business-as-usual (BAU) scenario (also referred to as the 'reference scenario'), without further actions to mitigate climate change, the Town's emissions will increase, largely due to population growth. From the base year of 2016, emissions are projected to increase 7% from 457 to 489 ktCO₂e, making decarbonization more of a challenge (see Figure 4).

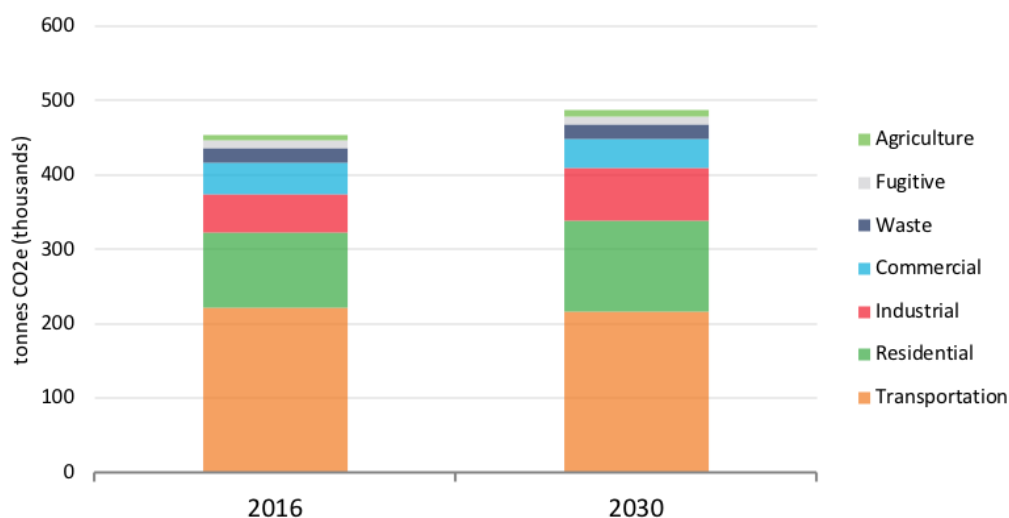


Figure 4. Town of Halton Hills projected emissions in a business-as-usual or 'reference' scenario, by sector, 2016-2030.

To move from business-as-usual to a net-zero future, Halton Hills must address its major sources of emissions which are projected in 2030 to be:

- 44% from cars and trucks (49% in 2016);
- 33% from commercial and residential buildings (32% in 2016);
- 14% from industry (11% in 2016);
- 4% from waste (same as 2016);
- 2% from fugitive emissions from natural gas distribution (same as 2016); and
- 2% from agriculture (same as 2016).¹¹

¹¹ Percentages add up to 99% due to rounding.

Efficiency First

In order to address these emissions, the LCTS adopts an efficiency-first approach (see Figure 5). This means that energy-related GHG emissions (i.e., transportation, buildings, industry, and fugitive) are first lowered via more efficient energy use where possible (e.g., increasing home insulation or working from home instead of driving to an office). Then, the remaining energy consumption is switched from fossil fuels to renewable energy. Improving energy efficiency first helps minimize the need for additional electricity capacity, thereby avoiding associated environmental impacts and financial costs.

For waste-related emissions, primarily from the decomposition of organic waste at the Region's landfill, efficiency first means minimizing the organic waste that goes to landfill, such as with a composting program.

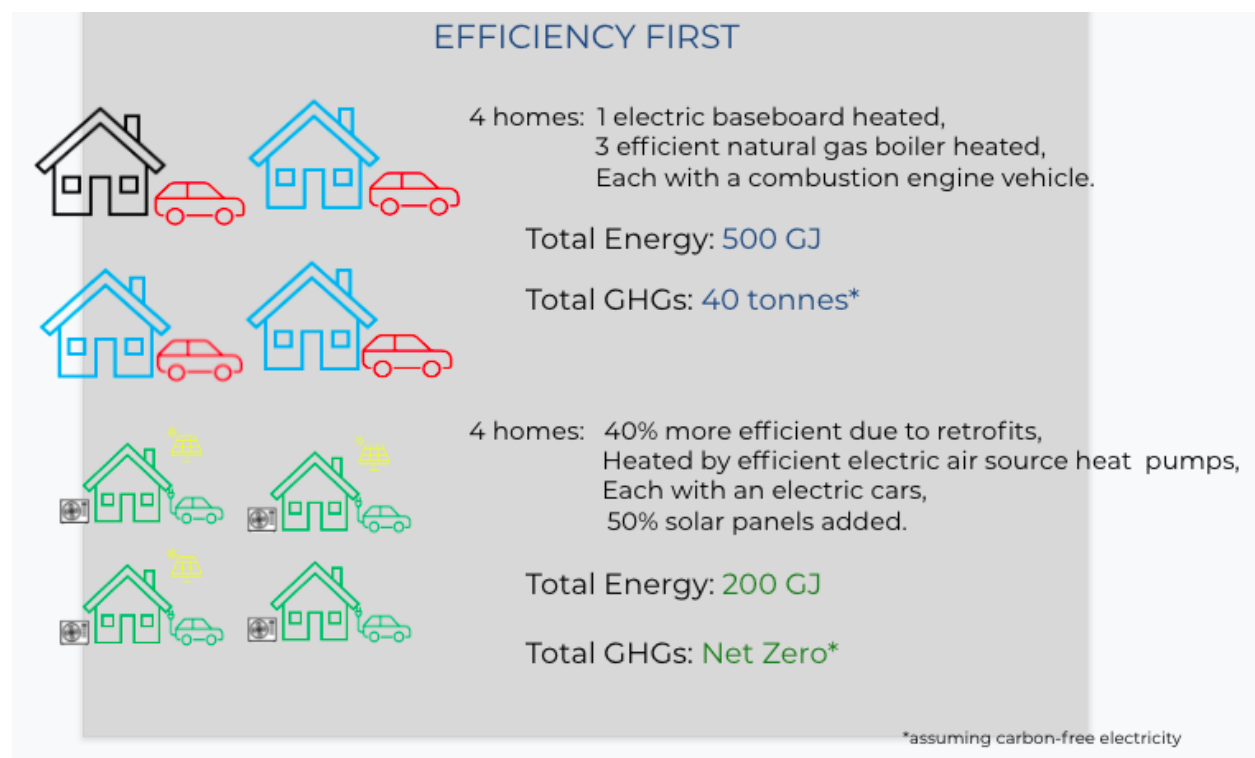


Figure 5. An infographic depicting the benefits of introducing efficiency first in a decarbonization strategy.

The Four Main Action Areas

The Town's pathway to net-zero (see Figure 6) is made up of four main action areas:

1. **Low-carbon mobility:** Enable travel by foot, bicycle, emissions-free transit, or electric vehicles.
2. **Energy efficiency and green development:** New and existing buildings are more energy efficient and are powered by renewable energy;

3. **Local renewable energy:** Replace fossil fuel energy with local renewable electricity and renewable natural gas; and
4. **Natural assets:** Protect and expand the town's natural carbon sinks, greenspaces and healthy soil, to offset some of the remaining emissions.

These four action areas are described in more detail below.

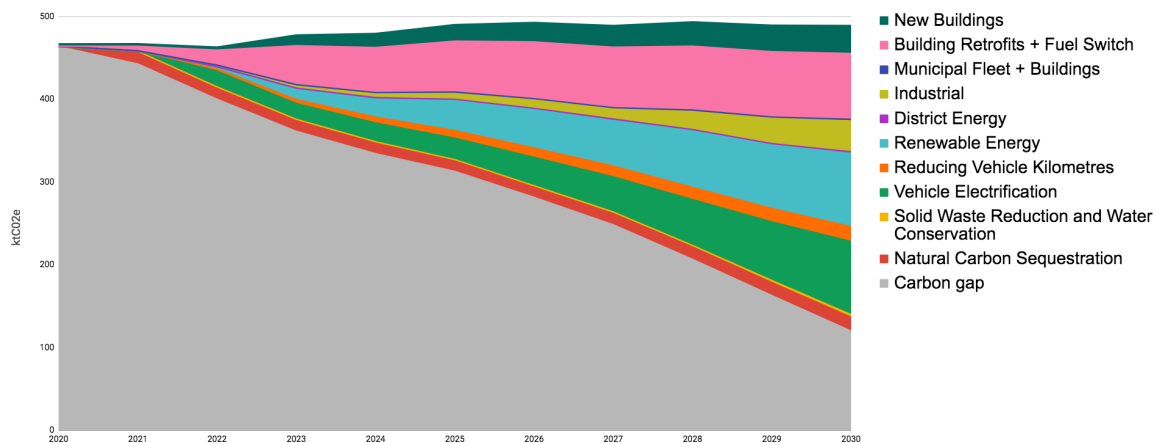


Figure 6. Net-zero scenario emissions reductions by sector (tCO₂e), 2020-2030.

(Note: Each wedge is a cumulative reduction from the business-as-usual scenario modelled for the Town.)

As for waste, the Town will collaborate with Halton Region, which currently manages the Town's waste collection and disposal, to tackle emissions. The LCTS recommends maximizing diversion of organic waste away from the landfill and exploring the potential to divert it to an anaerobic digester to produce local renewable natural gas.

Together, these four main action areas have the potential to reduce Halton Hills' emissions by 74% by 2030, even as the population and economy grow significantly. Remaining emissions (see Figure 7) in 2030 will be primarily due to:

- combustion engine vehicles purchased now and in the near future (63%);
- the local share of air and rail travel (20%); and
- organic waste from residents and businesses decaying in the Region's landfill (13%).

These will need to be offset or, ideally, addressed in future LCTS iterations with new policies or technologies.

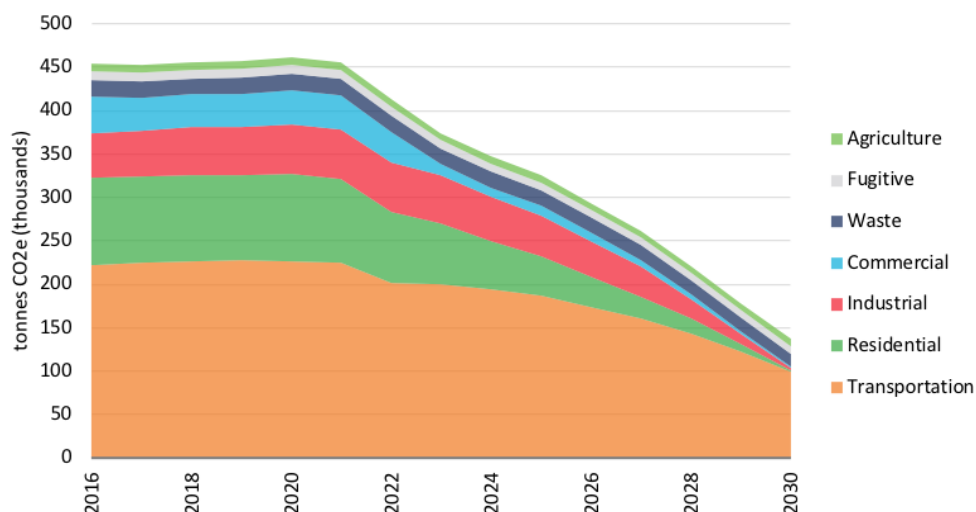


Figure 7. Town of Halton Hills LCTS emissions, by sector 2016-2030.

BOX: The stickiness of the transportation system

In Figure 7, vehicles are the primary source of remaining emissions. Phasing out emissions from vehicles by 2030 is challenging. The primary pathway to decarbonize transportation is to electrify vehicles. Electric vehicles can then be powered by renewable electricity. A typical vehicle in Canada will last for 10-12 years, so electrifying the fleet by 2030 would require that only electric vehicles are purchased by 2018-2020, which didn't happen. Currently the Government of Canada has indicated that their target for 100% of EV sales is 2035, more than 15 years too late.¹² In order to achieve its target, the Town has to encourage people to purchase as fast as possible through the various policies at its disposal, including early retirement of gasoline vehicles. It will also need to encourage people to get out of cars and use other zero emissions transportation modes such as walking, cycling and transit as soon as possible.

Other than purchasing offsets, which will come from outside of the community, all of the LCTS actions involve significant local co-benefits, such as:

- improving resident health and wellbeing,
- protecting local biodiversity and ecosystems,
- creating local jobs,
- improving resilience to extreme weather,
- improving economic resilience, and
- lowering household energy bills.

These co-benefits will be discussed throughout this report.

¹² Government of Canada, news release, 'Building a green economy: Government of Canada to require 100% of car and passenger truck sales be zero-emission by 2035 in Canada' (June 29, 2021).

For additional information on the reference scenario and net-zero scenario model results, see Appendix B and C.

1. Low-Carbon Mobility

The LCTS is a vision for a community with fresher air and more convenient options for walking, cycling, and public transit than exist today. By 2030, residents of Halton Hills will breathe in less air pollution as residents use their cars less and more people drive EVs. In addition, workers will commute less often with more flexibility to work from home—a shift that drives down emissions while improving well-being.

Who will benefit?

- People with chronic obstructive pulmonary disease or other respiratory ailments
- People who can't access cars (youth, elderly)
- Households under financial stress
- Construction companies (transit and active transportation infrastructure)
- People with home businesses

Emissions Profile and Low-Carbon Actions

In 2016, vehicles accounted for 49% of Halton Hills' emissions, primarily due to burning gasoline, and to a lesser extent diesel. With no new action, personal-use vehicles are expected to drive an additional 200 million kilometres a year by 2030.

In contrast, in the net-zero scenario transportation emissions drop by 55% and annual vehicle kilometres travelled (VKT) decrease by 125 million by 2030. This decrease in emissions is driven by a shift from internal combustion engine vehicles to electric vehicles (EVs) powered by renewable electricity. The associated cost to reduce each tonne of GHG associated with the transition to EVs represents savings for the community, especially the proposed EV car-sharing program, which would see many households avoiding the need to purchase a first or second personal use vehicle (see the table below and the textbox: What is a Marginal Abatement Cost?). The decrease in VKT is due to an increase in walking and cycling infrastructure, as well as improvements in public transit.

The actions modelled to achieve the transportation energy efficiency improvements and emissions reductions in the LCTS are detailed in the following table.

Box: What is a Marginal Abatement Cost?

The Marginal Abatement Cost (MAC) is the incremental cost of one tonne of GHG reductions. The lower the cost, the more affordable the action, and in some cases, the action can be profitable. It is calculated

by summing the net present value of capital costs and operating costs over the lifetime of the investments divided by the tonnes of GHGs reduced.

By providing individual costs for actions, MACs can imply that the actions are a menu from which individual actions can be selected. In fact, many of the actions are dependent on each other, for example, energy costs increase without retrofits. Another important message is that in order to achieve the Town's target, all the actions need to be undertaken as soon as possible.

MAC do provide useful insights that guide implementation planning:

- Can high cost and high savings actions be bundled to achieve greater GHG emissions reductions?
- How can the Town help reduce the costs of the high cost actions by supporting innovation or by providing subsidies?
- Which actions both save money and reduce the most GHG emissions?
- Which actions are likely to be of interest to the private sector, assuming barriers can be removed or supporting policies introduced?

Table 2. Summary of net-zero actions in the transportation sector, including associated GHG reduction and marginal abatement cost.

		GHG reduction NZS vs Reference cumulative	Marginal Abatement Cost \$/ tCO2e reduced (brackets) = savings
Transit >15km	Transit mode share to reach 15% for long-distance trips (>15km).	10 ktCO2e	(\$1,973)
Transit <15km	Local electric bus route established by 2030; Transit mode share for short-distance trips increases to 15% by 2030.	15 ktCO2e	(\$448)
Car share	Starting in 2024, an autonomous EV car share is introduced in the Town. By 2030, the system will serve 10% of trips.	24 ktCO2e	(\$6,343)
Active transportation	Active mode share accounts for 20% of trips under 5km by 2030.	2 ktCO2e	n/a
Work from home	30% of people telework by the year 2030. By 2030, trips will decline by 15%.	71 KtCO2e	(\$1,477)
Municipal fleets	Starting immediately, electrify 100% of new administrative vehicles at the time of replacement. At time of replacement, heavy vehicle classes are transitioned to RNG, where electric options exist they should be opted for.	2 ktCO2e	(2,008)
Personal vehicles	At time of replacement, 100% of new vehicles will be EVs by 2030, assuming an average combustion engine vehicle life cycle of 7 years (to be shortened from typical 11 years via policies/programs).	219 ktCO2e	(\$906)
Commercial vehicles	At time of replacement, 100% of new medium vehicles will be EVs by 2030, 50% of new heavy vehicles will be electric by 2030, and 50% of new heavy vehicles will be fuelled by RNG by 2030.	78 ktCO2e	(\$739)
Off-road vehicles	50% of new off-road vehicles are electric by 2030.	56 ktCO2e	n/a

Co-benefits

The low-carbon actions have positive economic and health benefits. The number of kilometres walked by residents will increase by 10%, while the number of kilometres cycled will increase tenfold by 2030. These changes will contribute to improved public health: as residents become more active, individual health will improve, and streets will become quieter and safer with fewer cars on the road. In addition, switching from internal combustion engine vehicles to EVs will improve public health by decreasing air pollution. Locals who live or spend time near a major arterial road or controlled access highway will see the biggest benefits as exhaust emissions decrease.¹³

Improving access to walking, cycling, and transit infrastructure can also enhance equity by making it cost-effective and convenient for residents who don't have, cannot drive, or cannot afford vehicles to move around.

Key Implementation Actions

A number of actions in the short-term (now through 2025) will help increase the uptake of EVs and increase active transport mode share.

- Expand EV charging infrastructure: The Town, working with key partners like Halton Hills Hydro, will expand EV charging infrastructure through a combination of government funding, partner resources, and Town budget. It will begin by assessing the current EV charging infrastructure and identifying priority gaps in the system.
- EV info days: The Town will work with partners such as Halton Hills Hydro, local businesses, and Plug & Drive to host recurring EV info days where residents can learn about and test drive EVs.
- Establish a commercial fleet decarbonization working group: The Town will support the development of a working group of local commercial fleet owners to support education, knowledge sharing, and encourage the adoption of fleet decarbonization targets.
- Offer a bike share program: The Town will complete a feasibility study and pilot a bike-share program. Based on the pilot's outcome, the Town will explore opportunities for further expansion, such as incorporating more bikes, e-bikes, or e-scooters.
- Deploy a local e-bus: The Town will conduct a study to identify the optimal local e-bus routes between population and employment hubs, as well as connections to active transportation and regional transit networks. This will include an assessment of the local Activan fleet which currently serves community seniors and people with disabilities. The Activan fleet will begin the process of

¹³ Public Health Ontario, Traffic-Related Air Pollution: Avoiding the TRAP zone (2016) online: www.publichealthontario.ca/-/media/documents/O/2016/ohp-trap.pdf?la=en.

electrification no later than 2024. The Town will consult key stakeholders and solicit federal funding for the system.

→ Expand walking and biking trails: The Town will prioritize improvement and expansion of walking and biking infrastructure in line with its Active Transportation Plan. In particular, road budgets will be reallocated to active transportation where possible.

2. Energy Efficiency and Green Development

The LCTS is a pathway to a community in 2030 with more comfortable buildings, lower energy bills, and greener industry. New buildings will be constructed to more stringent energy efficient building standards and existing buildings will be retrofitted to improve efficiency. The vast majority of buildings will be heated and cooled by local renewable electricity. Industry will reduce its reliance on fossil fuels and improve industrial process efficiency, lowering its energy bills.

Emissions Profile and Low-Carbon Actions

Space heating and industrial processes are Halton Hill's largest source of emissions. In 2016, residential buildings represented 31% and commercial/industrial buildings accounted for 33% of the town's energy consumption and about 21% and 22% respectively of its GHG emissions. Natural gas for heating and industrial processes was the largest contributor to these emissions. Heating oil was the second leading source of emissions, primarily from industrial uses.

In the net-zero scenario, energy consumption from all buildings and industrial processes drops by a quarter by 2030 as a result of new energy performance requirements, deep energy retrofits, and the incorporation of energy-efficient heat pumps for space and water heating. These changes drive down energy demand while reducing reliance on fossil fuels. Fuel switching remaining emissions to renewable electricity and renewable natural gas results in a 98% decrease in buildings and industry emissions.

The actions modelled to achieve the building and industry energy efficiency improvements and emissions reductions in the LCTS are detailed in the following table.

Who will benefit?

- Homeowners
- Building owners
- Construction workers and companies
- Private contractors
- Heating, ventilation, and air conditioning installers and manufacturers
- Building component manufacturers (windows, doors, insulation)
- Solar installation companies

Table 3. Summary of net-zero actions in the buildings sector, including their associated GHG reduction and marginal abatement cost.

		GHG reduction NZS vs Reference cumulative	Marginal Abatement Cost \$/ tCO ₂ e reduced (brackets) = savings
New Buildings			
Residential	New residential buildings to be constructed to increasingly stringent energy use standards. As of 2023, all new buildings to be net-zero ready (i.e., any GHG emissions are offset by community- or building-level renewable energy installations).	133 ktCO ₂ e	\$458
Commercial and industrial	New commercial and industrial buildings to be constructed to increasingly stringent energy use standards. As of 2023, all new retail and office buildings to be net-zero ready.	71 ktCO ₂ e	(\$711)
Municipal	New commercial and industrial buildings to be constructed to increasingly stringent energy use standards. As of 2023, all new buildings to be net-zero ready.	4 ktCO ₂ e	\$2,432
Existing Buildings			
Homes built prior to 1980	Retrofit 65% of buildings by 2030 (6% of buildings per year). Most retrofits are deep. (Average energy use intensity (EUI) reduction of 70% across retrofitted building stock.)	217 ktCO ₂ e	\$1,896
Homes built after 1980	Retrofit 50% of homes by 2030. Average EUI reduction of 50% across retrofitted building stock.	136 ktCO ₂ e	\$1,483
Commercial buildings	Retrofit 50% of commercial building stock. Average EUI reduction of 50% across retrofitted building stock.	92 ktCO ₂ e	\$109
Heat pumps	90% of retrofitted buildings receive an air-source heat pump (ASHP). 75% of non-retrofitted buildings receive an ASHP.	118 ktCO ₂ e	\$49
Industrial efficiency	Starting in 2022, industrial buildings and processes use 3.75% less energy than in the previous year, resulting in 30% less energy consumed by the year 2030, relative to the 2016 baseline.	98 ktCO ₂ e	\$210
Industrial fuel switch	30% of industrial process energy use (prioritizing fuel oil and then natural gas) will be displaced with renewable electricity and renewable natural gas by 2030.	38 ktCO ₂ e	(\$63)

Co-benefits

As building efficiency increases, energy consumption and associated costs will decrease, creating savings for residents, the Town, and businesses. By 2030, an average Halton Hills household will spend \$2,500 on fuel and electricity for household energy and transportation—almost 50% less than they would have in the reference scenario. Between 2022 and 2030, these add up to savings of \$12,000 for the average household. A community survey run during the course of the LCTS development gives a sense of the importance of energy bill savings to community residents (see Figure 8). At the same time, energy efficiency upgrades can improve ventilation, thermal comfort, and other characteristics of buildings, which leads to improved comfort, health, and productivity.

The industrial sector will benefit from greater energy efficiency and access to renewable energy. Shifting away from fossil fuels will create a net benefit, saving industry \$63 in energy costs for every tonne of CO₂e reduced. In addition, the shift to low-carbon buildings will contribute to the growth of the green construction sector by creating over 1,300 jobs (or 11,100 person years of employment between 2022 and 2030).

What is most important to you in a community climate change initiative?

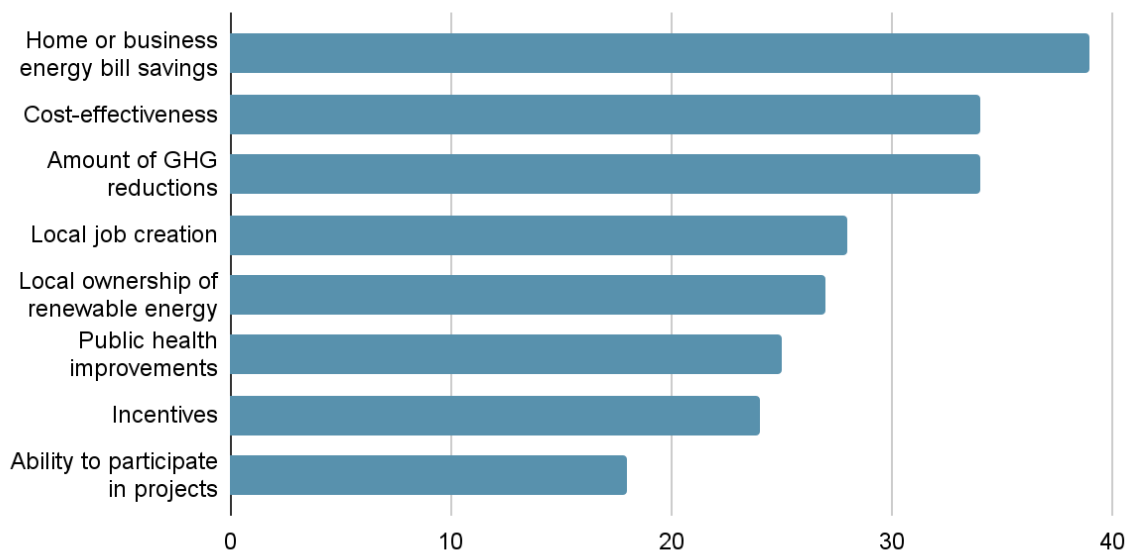


Figure 8. This community survey featured on the Town's Let's Talk Halton Hills site during May-June 2021 asked residents to "check all options that apply."

Key Implementation Actions

The Town will take a number of actions in the near-term (now through 2025) to overhaul existing buildings, as well as establish the requirements for new ones. These include:

- Deploy a residential retrofit program: The Town will complete a feasibility study and run a pilot retrofit program, including financing and an education campaign for homeowners and landlords. Based on learnings from the pilot, the Town will rapidly expand the program, seeking to cover about 1,500 houses a year as soon as a viable program has been demonstrated.
- Deploy a commercial retrofit program: The Town will consult small- and medium-sized businesses, map out the business ecosystem to identify relevant resources, and undertake a pilot commercial retrofit program, including financing and an education campaign. Based on learnings from the pilot, the town will expand the program.
- Deploy an industrial retrofit program: The Town will work with small- and medium-sized businesses to outline concrete actions and map out which businesses can provide services for the retrofit program. The Town will then undertake a pilot industrial retrofit program, including financing and an education campaign for industrial business owners and energy managers. Based on learnings from the program, the Town will expand the pilot.
- Enhance the GHG performance of new construction: The Town will continue to implement and strengthen its Green Development Standards to ensure new developments align with its net-zero by 2030 target.
- Ensure Vision Georgetown is a net-zero emissions community: The Town will seek to implement the recommendations of the Low-Carbon Energy Supply Study for Vision Georgetown.

3. Local Renewable Energy

LCTS imagines a Halton Hills where buildings and vehicles are mostly powered by renewable energy generated by the sun. By 2030, residents will spend less on energy, generate power with solar panels on their homes, and receive returns from the local renewable energy co-operative. Natural gas use that remains will be replaced by renewable natural gas generated from organic waste while a geothermal district energy system will heat buildings in Vision Georgetown.

Halton Hills Hydro and Halton Hills Community Energy Corporation will be key implementation partners for this vision, which they helped shape as members of the MSGC.

Who will benefit?

- Homeowners
- Building owners
- Electricians
- Private contractors
- Solar companies
- Investors

Emissions Profile and Low-Carbon Actions

Despite major improvements in efficiency across all sectors and a mass fuel-switching program from fossil fuels to low-carbon electricity, the Town will still have some remaining fossil fuel emissions in 2030 if no further action is taken. Those emissions related to natural gas use can be minimized through greater use of renewable natural gas. Those emissions related to central grid electricity consumption can be minimized by increasing local renewable electricity generation.

The local economic benefits of these actions can be maximized if energy is produced locally. For the purposes of the LCTS, solar is considered the primary source of local renewable electricity generation within Town boundaries. This is because of local sun exposure, as well as rooftop and available land area for panels. Wind potential would need to be the subject of further study. Because waste is managed by the Region, it was assumed that any RNG would be procured from outside Town boundaries. However, there is significant potential for a centralized and/or smaller scale anaerobic digesters (e.g., on farms) where organic waste is diverted from landfill and used for energy.

The local renewable energy generation actions in the LCTS are detailed in the following table.

Table 4. Summary of local renewable energy generation LCTS actions, including their associated GHG reduction and marginal abatement cost.

		GHG reduction NZS vs Reference cumulative	Marginal Abatement Cost \$/tCO ₂ e* <i>*(brackets) represent savings</i>
Solar PV - rooftop	By 2030, install 30% of feasible rooftop solar PV potential (46 MW based on roof analysis), starting in 2022. This results in an annual installation of 5.6 MW.	20 ktCO ₂ e	(\$1,767)
Solar PV ground mount - utility scale	Solar capacity built to meet the Town's remaining central grid electricity demand in 2030, 445 MW of solar capacity (about 13% of available undeveloped settlement land and cropland).	206 ktCO ₂ e	(\$4,263)
Renewable natural gas (RNG)	RNG will be procured to replace remaining natural gas demand starting in 2030.	192 ktCO ₂ e	\$56

Co-benefits

Between 2022 and 2030, local solar energy generation will create over 3,000 person years of employment, including for the installation of residential and commercial rooftop solar, as well as large-scale ground mount installations.¹⁴ In addition, the Town is evaluating the potential of establishing a renewable energy co-operative, which could generate returns for community members who join it. Halton Hills households are also expected to save an average of \$16,600 each on household energy and transportation expenditures between 2022 and 2030, thanks in part to local renewable energy developments that will keep energy dollars within the community.

Key Implementation Actions

The Town will take a number of actions to increase local renewable energy generation in a way that creates economic benefits for the community. The following have been identified as key near-term actions:

- Plan a next generation electricity system: The Town will hire a consultant to undertake an hourly analysis of how the energy efficiency improvements and electrification included in the LCTS will affect the electricity system and how the demand can be balanced to ensure a stable, reliable grid.
- Establish a renewable energy co-operative: The Town will create a public education campaign to raise awareness of the benefits of creating a renewable energy co-operative, which would give Halton Hills residents a chance to own local renewable energy developments. The Town will also work with the LCTS committee to search for potential local groups to establish the co-operative.
- Develop large-scale solar capacity: Starting in 2022, the Town will establish criteria for large-scale solar installations and identify locations for solar installations before identifying one or more developers for the project.
- Evaluate renewable natural gas: The Town will meet with the Region to discuss how the Region's organic waste management policies can align with the Town's net-zero target. The Town will also work with the Region to undertake a feasibility study and economic analysis to explore the possibility of developing a centralized anaerobic digestion facility and renewable natural gas refining facility.

¹⁴ These are average annual full-time-equivalent job hours over the 2022-2030 investment period.

4. Natural Asset Management

The LCTS envisions a Halton Hills with cleaner air, more trees, and denser neighborhoods with convenient connections to walk, bike, and cycle from place to place. At the same time, farmers will improve their sustainable soil management practices, leading to lower emissions and increased crop productivity.

Who will benefit?

- The community
- Birds and bees
- Farmers
- Foresters

Emissions Profile and Low-Carbon Actions

Agriculture, primarily from livestock, is estimated to account for 2% of total emissions in Halton Hills in 2016. While agriculture's share of emissions will increase to 7% in the low-carbon scenario, the amount of emissions (8 ktCO₂e) is expected to remain constant. At the same time, efforts to protect and enhance green space, including improved soil management practices and tree planting, will reduce emissions by 147 ktCO₂e.

Improved green spaces and healthy soil actions in the LCTS are detailed in the following table.

Table 5. Summary of net-zero actions related to green spaces and healthy soils, including associated GHG reduction and marginal abatement cost.

		GHG reduction NZS vs Reference cumulative	Marginal Abatement Cost \$/tCO ₂ e* <i>*(brackets) represent savings</i>
Tree planting	Starting in 2022, plant 50,000 trees in Halton Hills per year.	37 ktCO ₂ e	\$25
Soil management	15% increase in land under sustainable soil management practices by 2030 (i.e., no-till farming).	9 ktCO ₂ e	n/a
Spatial distribution of new buildings	All new developments, apart from Vision Georgetown, are infill (i.e., no greenfield development).	101 ktCO ₂ e	n/a

Co-benefits

In addition to sequestering carbon, the focus on green spaces and healthy soils will create a number of social, health, and economic benefits for the community. Limiting greenfield development will ensure existing green space is preserved, which provides animal habitat and mitigates the heat island effect. Increased tree canopy will improve air quality. Enhanced green spaces will also benefit the wellbeing of community members who use them. Sustainable soil management can increase crop productivity, which can increase farmers' incomes and contribute to better quality of life.

All of these actions also have the potential to improve the community's resilience to extreme weather events. In fact, many of these actions also form part of the Town's Climate Change Adaptation Plan. Ideally, these actions would be implemented in a manner that maximizes both outcomes: carbon sequestration and climate adaptation.

Key Implementation Actions

The Town will take a number of actions to improve natural carbon sequestration of GHG emissions, these include:

- Establish a tree canopy management and expansion planting program: The Town, with support from local conservation authorities, will develop a tree planting target and associated planting program.
- Improve soil health: The Town will work with other levels of government, local conservation authorities, and farming associations to assess the state of soil management programs and related carbon sequestration monitoring. Based on its findings, the Town and local partners will identify ways to build on this work and increase land under sustainable soil management practices.
- Increase density: The Town will review policy frameworks to support increased densification, more walkable and bicycle-friendly communities, and the development of active transport and transit networks that enable density—all while maintaining the community's small town feel.

For additional information on the:

- **actions modelled in the LCTS, see Appendix A;**
- **the reference scenario model results, see Appendix B;**
- **the net-zero scenario model results, see Appendix C;**
- **the financial and economic analysis results, see Appendix D; and**
- **the near-term implementation plan, see Appendix E.**

Part III: Going Forward

Turning to Action

Many investment decisions made today will last to 2030 and beyond. If the community chooses to build sprawling developments, people in Halton Hills will find it harder to walk and bike to their destinations for years to come. If the community constructs homes with few energy efficiency features, those living in them will be on the hook for higher energy bills, possibly for generations.

Getting to net zero by 2030 requires the entire community to take action as soon as possible. Even as the cost of low-carbon technology continues to decline in many areas, there are many financial benefits to acting now. Ensuring that no new major investments, such as new buildings and vehicles, lock the Town into a fossil-fueled future helps minimize stranded assets (i.e., assets that will need to be retired before their natural end of life). Reducing energy consumption helps reduce energy bills and free up electricity capacity for the many new forms of electricity demand (e.g., EVs and electric heat pumps).

To ensure LCTS investments result in successful outcomes, the following key principles will guide the Strategy's implementation:

- Collaboration and innovation,
- Community participation and oversight, and
- Equitable growth.

These principles are discussed further below.

Collaboration and Innovation

The whole community must come together to bring the LCTS to life. Residents, businesses, institutions, and organizations need to:

1. learn about and spread awareness of the LCTS and related initiatives among family members, neighbours, and colleagues;
2. participate in retrofit programs and make low-carbon transportation choices; and
3. partner to deliver programs.

Getting to net zero also requires the **political and financial support of other levels of government:** regional, provincial, and federal. For example, the Province must decarbonize the electricity grid and strengthen its energy efficiency regulations, while the Region must divert as much organic waste as possible from landfills.

Technologies to decarbonize homes and cars exist, but transitioning vehicles and retrofitting buildings at scale and in short order demands **innovation in program delivery and financing**. In order to reach net zero by 2030, the Town will:

- learn from best practices in other communities (for example Bristol UK's City Leap partnering with the private sector to achieve their net-zero by 2030 target,¹⁵ and Europe's mass deep energy retrofit program 'Energiesprong');¹⁶
- take risks by trying new programs and policies; and
- collaborate with neighbouring communities by sharing resources to achieve more with less.

Community Participation and Oversight

The Town plays a leadership role in the LCTS. It has already committed to decarbonize its assets by 2030; however, Town operations represent a minority of emissions into the community. Getting to net zero requires action from the entire community. Businesses need to set net-zero targets and provide net-zero products and services. Households need to retrofit their homes and make carbon-free transportation choices. Success will depend on whether the community learns about the LCTS and gets involved. The LCTS requires a major public education and marketing campaign.

To ensure the community is held accountable to the LCTS and meeting its net-zero-by-2030 target, regular public GHG emission reporting, by sector, will be necessary, as well as reporting on program-specific metrics. Town Council will need to receive annual reporting, and benefit from direct oversight and input from the community. Incremental LCTS reviews, based on regular reporting will also be critical, this will allow for further refinement and updates to be made.

¹⁵ See: www.bristol-energy.co.uk/cityleap.

¹⁶ See: energiesprong.org/about/.

When it comes to overseeing the LCTS' implementation, what is important to you?

"Show a clear plan a clear budget and updated results shown to the community."

"Showing how the Town of Halton Hills is working with our local municipal partners"

"Making sure public and private sector groups/corps are actually carrying their weight."

"That the Town does what it can to offer financial incentives to help people make the changes they want to make. Subsidizing purchases, etc"

-Select Town survey responses (2021).

Equitable Growth

With the LCTS, our community is starting down a path that will enable us to capture economic opportunities arising from decarbonization while increasing the wellbeing of residents.

Although the Town of Halton Hills is more affluent than the national average, the Town still has some low-income and under-employed residents. The transition requires significant movement of capital, which provides an opportunity for equitable redistribution, rather than further entrenching existing inequities. Though the majority of low-carbon actions more than pay for themselves over time, they often have relatively high upfront costs that may exclude low-income groups from participating. For example, retrofits may be too costly for low-income households, and some households may not own their own home. At the same time these low-income households generally have a higher energy burden, paying more for fuel for older inefficient vehicles and spending more on electricity and natural gas to power and heat older, inefficient homes. These are the residents that stand to benefit most from many LCTS programs; however, they may be left behind if programs are not tailored to their financial capacity.

Local suppliers, local expertise, local business, and local labour can all be leveraged to deliver the pathway to net zero by 2030. The Town can help maximize these local opportunities by ensuring local training for LCTS-related jobs is made accessible to members of the community, especially those that are currently under-employed, and that LCTS-related procurement is designed so that local businesses have an opportunity to participate.

Finally, renewable energy, such as large scale solar can and should be developed in such a way to maximize local benefits. Community ownership structures, such as cooperatives, help local revenue stay in the community and give residents a chance to invest in renewable energy.

What can the Town do to facilitate you getting involved in the LCTS?

"Have a regular sustained public education/information strategy that emphasizes positive aspects of reducing our carbon footprint, using all available media."

"More fast charging stations for electric vehicles."

"Make local transit a priority."

"More trails to facilitate movement through the community."

"Give options that work for people of all age groups and incomes."

"community tree plantings"

"Be transparent about plans."

-Select Town survey responses (2021).

Towards a Sustainable, Circular Economy

The LCTS begins to define what sustainable growth looks like for Halton Hills: growth that enables the community to reduce its emissions in line with its net-zero-by-2030 target, while preserving the environment, improving quality of life, and decreasing inequity. The Town is committed to ongoing research and innovation to address the remaining carbon gap presented by this LCTS.

Going forward, the Town will continue to work to define sustainable growth. This is likely to include a more holistic carbon lens that accounts for a broader range of emissions. For example, while this plan accounts for building emissions from the energy required to power and heat buildings; a more holistic lens would consider the emissions from producing the steel and cement used to construct buildings. By starting to consider emissions from "cradle to grave", the community can place less value on carbon-intensive goods relative to goods produced with renewable energy, increased energy efficiency, and recycled materials. This helps move the community towards a more sustainable, circular economy.¹⁷

With the LCTS, Halton Hills is starting down an important path to becoming a thriving, more sustainable community, and economy. The LCTS reflects a community that is optimistic about its future, knows it is growing, and is not afraid to innovate and change.

This Strategy for a low-carbon Halton Hills is put forward in the context of what will be one of the great transitions in the story of human civilization: the transition to an ecologically sustainable and healthy

¹⁷ To learn more about the circular economy, check out Doughnut Economics by Kate Raworth.

economic system that runs on renewable energy and circular flows of materials. It is in its early stages, but it is building momentum from the ground up through thousands of local initiatives like this one. Like a train pulling out of a station, at first progress seems slow and the destination impossibly far away, but it will gain speed quickly. It will require resolve to implement and the ability to embrace the disruption that inevitably accompanies grand transitions. This will be possible if the community is confident that the journey will lead to a healthier and more sustainable economy.

Appendix A: Table of Actions

Appendix B: Net-Zero Model Results

Appendix C: Reference Scenario Model Results

Appendix D: Net-Zero Financial Results

Appendix E: Implementation Framework

Appendix F: Data, Methods, Assumptions Manual