CLIMATE ACTION WR

TRANSFORM WR

Waterloo Region's Transition to an Equitable, Prosperous, Resilient Low Carbon Community

“If you can do something about it, why wouldn’t you want your Earth to live longer?”

Edward, 10 years old

I. EXECUTIVE SUMMARY

TransformWR is Waterloo Region’s community-wide response to the global climate crisis. Understanding that we need to take action as a community, the following outlines our long-term strategy to achieve an 80% local greenhouse gas emission (GHG) reduction target (based on 2010 levels), and identifies local action needed to reduce our emissions by 30% by the year 2030. We must take bold and immediate action to ensure that we are doing everything we can locally to exceed these targets and do our part in achieving the Paris Agreement objectives.

Our **call to action** is to transform our community, in the ways we move, the ways we build and operate our spaces, the ways we produce, consume and waste, and the ways we relate to one another. Six **Transformative Changes** will guide us along that journey:

1. By 2050, most trips are taken using active transportation, with the support of a robust public transit system;
2. By 2050, remaining personal and commercial vehicles are zero emission vehicles;
3. By 2050, businesses and homes no longer use fossil fuels for space heating and cooling, and hot water heating;
4. By 2050, Waterloo Region uses less, wastes less, and no longer disposes of organic matter in landfills;
5. By 2050, Waterloo Region has a thriving local food system built on local farming and food production and processing that feeds much of our community; *and*
6. By 2050, Waterloo Region has leveraged reducing GHG emissions to increase equity, prosperity, and resiliency for all.

For each Transformative Change, a set of strategies and action items have been identified, along with key **milestones** to help track our progress. The outcome of this collective action will lead to achieving our **vision for 2050**, and **ultimately** transform Waterloo Region into an equitable, prosperous, resilient low carbon community.

Every community member, business, organization, and local municipality has an important role to play in Waterloo Region’s transition to a low carbon community. This strategy is meant to influence all future planning. Official plans, corporate plans, organizational planning etc. should look to this document, and the work outlined in the following should be integrated into all planning processes for the next 30 years, to align our community with success. Achieving and exceeding the goals outlined in this plan also depends on bold and immediate action by other levels of government beyond Waterloo Region. As a result, advocacy is a key part of this strategy. This is a launching point for the next 30 years of local climate action, and the years ahead of us are where the real work comes into play.

CALLS TO ACTION	TRANSFORMATIVE CHANGES	MILESTONES
The things we do to help us achieve the milestones & outcomes	The big changes that need to occur by 2050	The measurable results of our actions
TRANSFORM THE WAYS WE MOVE	Most trips are taken using active transportation, with the support of a robust public transit system. Remaining personal and commercial vehicles are zero emissions vehicles.	By 2050, personal vehicle trips between homes and workplaces have been reduced 40% due to work from home options, and 10% by 2030. By 2050, discretionary trips have been reduced by 18% (in km's) and 4% by 2030. By 2050, vehicle trips over 5km have been reduced by 10%, (in km's) and by 2% in 2030. By 2050, vehicle trips under 5km have been reduced 80% by using active transportation, and 10% by 2030. By 2050, 99% of gasoline and diesel vehicles are switched to zero emission vehicles, and 50% by 2030.
TRANSFORM THE WAYS WE BUILD & OPERATE OUR SPACES	Businesses and homes no longer use fossil fuels for space heating and cooling, and water heating.	By 2050, 85% of buildings use electric heat pumps, or equipment that is at least as energy efficient and low carbon as heat pumps, and 20% by 2030. By 2050, 85% of buildings use energy efficient and low carbon water heaters, and 20% by 2030 By 2025, fuel oil and propane use for building heating is 100% eliminated.
TRANSFORM THE WAYS WE PRODUCE, CONSUME, AND WASTE	Waterloo Region uses less, wastes less, and no longer disposes of organic matter in landfills. Waterloo Region has a thriving local food system built on local farming, and food production and processing that feeds much of our community.	By 2050, we will have maintained the same level of methane emissions from our landfills as we had in 2010. By 2050, we will have maintained the same level of methane emissions from livestock as we did in 2010.
TRANSFORM THE WAYS WE RELATE	Waterloo Region has leveraged reducing GHG emissions to increase equity, prosperity, and resiliency for all.	Next steps: Establish metrics to measure progress in reducing inequities, and creating climate action solutions that increase equity. By 2050, 38% of electricity used locally is produced locally from carbon neutral, renewable sources, and 4% by 2030.

VISION FOR 2050

The outcomes of our transformed region in 2050

Our region is a leader of climate action in Canada. And people across the community take pride in this.

Local resources, providers, supply chains and mindsets propel our economy.

We're a community where everyone has the opportunity to access and make sustainable choices.

Neighbourhoods help people meet their unique needs and thrive close to home.

People of all ages and abilities are moving around the region in active, clean, convenient, accessible ways. And our quality of life has improved as a result.

We grow more of our own food and make more of our own energy. As a result, we're more conscious of what we need, what we use, and what we waste.

The health and vitality of our local environment are echoed in our personal wellbeing.

Our infrastructure is a living expression of nature's resilience and elegance.

THE ULTIMATE WHY

The community benefits we're working towards

EQUITABLE
PROSPEROUS
RESILIENT

II. CLIMATEACTIONWR COLLABORATIVE

This work was made possible through the collaborative efforts of eight municipalities, local organizations, and community members.

The 10 organizations formally completing the project through the ClimateActionWR collaborative are:

The City of Cambridge

The City of Kitchener

The City of Waterloo

Reep Green Solutions

The Region of Waterloo

Sustainable Waterloo Region

The Township of North Dumfries

The Township of Wellesley

The Township of Wilmot

The Township of Woolwich

The project has been led by a committee composed of representatives from each:

CURRENT COMMITTEE MEMBERS:

Lisa Keys, Manager of Facilities, City of Cambridge

Claire Bennett, Corporate Sustainability Officer, City of Kitchener

Anna Marie Cipriani, Sustainability Coordinator, City of Waterloo

Samantha Tremmel, Plan Manager, ClimateActionWR

Mara Mackay, Project Coordinator, ClimateActionWR

Mary Jane Patterson, Executive Director, Reep Green Solutions

Kate Hagerman, Manager of Environmental Planning & Sustainability, Region of Waterloo

Kate Daley, Environmental Sustainability Specialist, Region of Waterloo

Tova Davidson, Executive Director, Sustainable Waterloo Region

Michelle Poissant, Recreation & Community Services Coordinator, Township of North Dumfries

Wendy Huber, Recreation/Fire Department Administrative Assistant, Township of Wellesley

Ashton Romany, Manager of Finance / Deputy Treasurer, Township of Wilmot

Ann Roberts, Environmental Coordinator, Township of Woolwich

PAST/CONTRIBUTING MEMBERS:

Paul Wilms, Sustainability Planner, City of Cambridge

Michelle Lee, Senior Policy Planner, City of Waterloo

Sue Arndt, ClimateActionWR

Katarina Milicic, ClimateActionWR

Sarah Fries, ClimateActionWR

Andreas Mertes, ClimateActionWR

Matthew Day, WR Community Energy

III. LAND ACKNOWLEDGMENT

We acknowledge that Waterloo Region, including the three cities and four townships, is located on the traditional territory of the Haudenosaunee, Anishnaabe and Neutral People. We recognize the enduring presence of the Indigenous people with whom we share this land today, their achievements and their contributions to our community. We value their traditional knowledge about how to live sustainably on this land that we share and will leave for our future generations. As a community we are committed to engage in the necessary learning, building of relationships, and action required to work towards reconciliation between Indigenous and non-Indigenous peoples in our community.

To learn more about the importance of land acknowledgements and the Indigenous communities on this territory, you can visit the website of LSPIRG Know the Land.

IV. ACKNOWLEDGEMENTS

The ClimateActionWR collaboration acknowledges the input of many individuals and organizations that participated in the development of this strategy.

In particular, we acknowledge the organizations below for their valuable contributions to this work:

- Federation of Canadian Municipalities (FCM). ClimateActionWR received financial assistance to develop this Community Climate Action Strategy from the FCM Transition 2050 Grant
- Unless Design Partners
- WalterFedy
- Viessmann Centre for Engagement and Research in Sustainability (VERiS)
- McDiarmid Climate Consulting
- ClimateActionWR Sector Committee Members
- ClimateActionWR Street Team Volunteers

V. A MESSAGE FROM THE CLIMATEACTIONWR COLLABORATIVE

First and foremost, we want to thank the members of our community who helped shape this plan, whether it was through sharing your vision for 2050, participating in a workshop, having a conversation, or through climate action efforts of your own or as part of our community.

We hope you, the reader of this document, see yourself in this better future we are committed to creating. The vision and actions outlined in this document are not only included to make your future, and that of your family, better in years to come. They are also included to help you chart your path to being part of the creation of this better community for all. We hope you are inspired by what you read, that you are encouraged to take action in your daily lives as you travel through our community, and in your work and home life as well. You are an essential part of this plan. You have inspired it and all that worked on it.

Now is the time to act! Please read through this document, look for the ways you see yourself in it, and join the entire community in helping to create a better future for us today and for generations to come. Together we can build a stronger, healthier, more sustainable future!

-The ClimateActionWR
Collaborative Partners Committee

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INTRODUCTION

TransformWR is Waterloo Region's strategy to do our part in addressing climate change, in order to create a low carbon community that is equitable, prosperous, and resilient.

What's laid out in the following is a pathway for how our community will build upon its history of climate action and show leadership in reducing greenhouse gas emissions that lead to climate change.

The opening sections provide context for how this strategy was developed, and how it should be used. This includes the foundations this strategy must build from, the challenges it must address, and the opportunities it must realize. The section entitled **Climate Change and Climate Action**, frames the global and Canadian contexts within which our region is situated. **Understanding our Target** and **Our Journey to '80by50'** lay out the critical work that's already happened and demonstrate momentum for an ambitious 30-year agenda for achieving Waterloo Region's greenhouse gas (GHG) reduction target of 80% by the year 2050.

This agenda is nothing short of transformational. It is simultaneously seeking to honour our history and reconcile our past, embrace the interconnectedness of our economic, social and ecological realities, and leverage our commitment to a more just future for both people and the planet.

It's a community plan.

More than 1600 community members informed this work through events, workshops, interviews, focus groups, and surveys. Efforts were made to reach stakeholders across the entirety of Waterloo Region, hearing from people from a variety of backgrounds, ages, sectors, job titles, and education levels. *See Appendix A for the full Community Engagement Summary.*

This work is directly informed by widespread community engagement that brought to light the community's fears, hopes, and ideas for what a flourishing region ought to look like in 2050. Regardless of perspective, everyone consulted influenced and informed this work.

What emerged were glimpses of a hopeful future—**Our Vision for 2050**—that helps us visualize the reality of meeting our targets.

The vision led to a set of common elements—**Principles**—that serve as guidelines for making decisions and keeping us on track when unexpected obstacles and outcomes arise. They are meant to help when we get lost in the complexity of a problem, or when we need a reminder about what's most important.

Neither the vision nor the principles contain the exact series of steps to reach our goals. To guide this, **Transition to a Low Carbon Community** outlines the **6 Transformative Changes** our community must collectively make. It outlines what we need to achieve as a community to make this vision a reality, and what we expect to see, feel and experience along the way.

There will be many obstacles and challenges that face our community in the coming decades. *TransformWR* sees the connections between these obstacles and the climate reality we face and takes a holistic approach to turning our vision of 2050 into reality.

FYI: Throughout this document, when we refer to 'Waterloo Region' or 'the region,' we are describing the entire community in the geographic area. When we refer to 'the Region' or 'the Region of Waterloo,' we mean the Regional Municipality of Waterloo, which is the upper-tier government in this area.

CLIMATE CHANGE AND CLIMATE ACTION

Climate change is a global problem with local causes and local solutions. The United Nations Framework Convention on Climate Change (UNFCCC), explains climate change as the changes in our climate that are directly or indirectly associated with human activity. The results of these activities alter the balance of our global atmosphere and lead to increasing global temperatures beyond naturally occurring climate variability.

That explanation leaves out a critical piece: it's harmful. For people and all living things. It's also only part of the story. Climate change is a signal that this planet is out of balance in devastating ways.

Without doubt, the biggest contributor to climate change is greenhouse gas emissions (GHGs). Many GHGs come from natural sources, but the accelerated changes in our climate that we are seeing are a result of human activity and the systems we have created, mostly as a result of burning fossil fuels for energy (see section titled: Transforming our Energy and our Community).

As we move forward—as individuals, as communities, as nations and as a species—we must think of climate change and climate action in two ways: adapting to the changes in our climate that are already happening and are now out of our control, and mitigation to focus on the causes of climate change and reduce GHG emissions for us and for future generations. This strategy focuses specifically on mitigation.

In 2015, 196 parties around the world agreed to the terms of The Paris Agreement. This international agreement outlines a long-term goal to limit average global temperature increases below 2°C, with a target of 1.5°C compared to pre-industrial levels. The Pan Canadian Framework on Clean Growth and Climate Change is Canada's approach to fulfilling our Paris Agreement commitments. At the provincial level, the Made-in-Ontario Environment Plan aims for a 30% GHG reduction by 2030 (below 2005 levels). To do our part locally, Waterloo Region has committed to our '80by50' target. At the time of writing, there is crucial momentum building for even more significant targets by provincial and federal levels of government.

This is a global challenge with local causes and local solutions, which is cause for optimism, inclusion, and hope. *TransformWR* is our strategy to significantly transform many parts of our community—for the better, and shows that we can do our part in Waterloo Region to address this global challenge.

UNDERSTANDING OUR TARGETS

This strategy is built on two distinct GHG emission reduction targets, both of which are based on 2010 levels; our long-term '80by50' target to reduce GHG emissions 80% by 2050, and our short-term '30by30' interim target to reduce GHG emissions 30% by 2030 (See 'Our Path to 2030' for details on this target).

When we talk about reducing GHG emissions, we start with an inventory, which is how we officially count our local emissions. Our first community GHG emissions inventory was based on 2010 data, and we have used that as our baseline emissions, from which we compare our reduction efforts against over time.

A follow up inventory was completed in 2015, and our next will be based on 2020 data and published in 2022.

Historically, our local inventories have been conducted by collecting data from five primary sectors:

- Transportation
- Workplaces / Schools
- Homes
- Agriculture
- Waste

What produces one tonne of CO_2e?

25

ROUND TRIPS FROM UPTOWN WATERLOO TO DOWNTOWN TORONTO WITH A TOYOTA COROLLA

2

ROUND TRIP FLIGHTS FROM TORONTO (YYZ) TO VANCOUVER (VYR)

Our GHG emissions are reported as a measure of carbon dioxide equivalent (CO_2e). This is a term used to describe different GHGs in a common unit. Greenhouse gases like methane (CH_4) and nitrous oxide (N_2O), each have different impacts on climate change. For example, 1 tonne of methane has the same impact on climate change as 25 tonnes of carbon dioxide, so it is expressed as 25 tonnes of CO_2e.

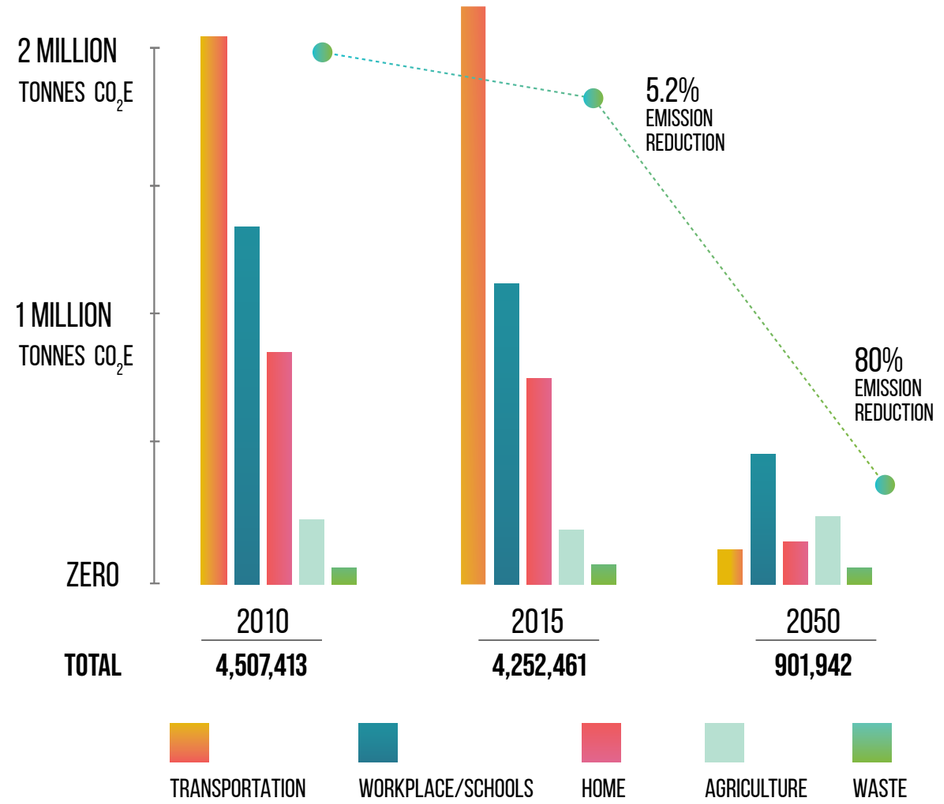


Figure 1: Results of Waterloo Region's 2010 and 2015 GHG inventories show a local GHG reduction of 5.2%. To achieve our long-term 80% reduction target, significant collaborative efforts will need to be made over the next 30 years.

Transportation, workplaces, and homes have been the largest contributors of GHGs in our local inventories, which reflects how energy is used in our community. With 94% of our emissions coming from these sources, TransformWR prioritizes how we use energy.

Achieving and exceeding the '80by50' and '30by30' goals outlined in this strategy will depend on bold and immediate action by provincial and federal levels of government, and therefore advocacy is a key part of this work.

OUR JOURNEY TO 80BY50

CLIMATEACTIONWR IN THE COMMUNITY

It's often said that a long journey begins with a single step.

In Waterloo Region, our community has long understood the imminent need for local climate action. Fortunately we have already taken many steps on the journey towards being a low carbon community.

For over a decade, **we've developed a culture of collaboration around climate action**. Stemming from an initial collaboration between Reep Green Solutions, Sustainable Waterloo Region, and the Region of Waterloo, ClimateActionWR was born to serve the community by working to mitigate climate change by reducing local greenhouse gas emissions at their source. In 2013, the Cities of Cambridge, Kitchener and Waterloo, and the Region of Waterloo collaborated to develop our region's first climate action plan, *A Climate Action Plan for Waterloo Region*. This provided the foundation of our baseline inventory and aimed to achieve a local GHG reduction target of 6% by 2020.

Through careful measurement and the completion of our second GHG inventory for 2015, the results of which were released in *Our Progress, Our Path*, we've **built a thorough understanding of our local climate impact** and where our community can take meaningful action.

Since then, local sustainability networks have grown significantly. Broader and deeper partnerships on climate action now exist among local organizations and all eight municipalities.

We've built momentum for change across the region. Over the last ten years, our emissions inventories, reduction targets, and action plans have been key drivers for major projects in diverse sectors across the community. They've informed projects and initiatives such as:

- ION Light Rail Transit (LRT)—an electrified rail service to meet our community's future transportation needs

- evolv1—Canada's first certified zero carbon building
- Expansion of our local publicly accessible EV charging station network
- Completion of over 2,000 home energy retrofits and ongoing advocacy to federal and provincial governments for greater incentives to support home energy retrofits
- Project Neutral—an online tool for calculating household emissions
- Expansion of the Region's green bin and waste management programs

We've shown climate leadership. Building on our first community target, in 2018 the organizations and municipalities in the ClimateActionWR collaborative began looking ahead and worked to establish a new long-term target. The resulting '80by50' target was endorsed by each municipal council across the region: the Region of Waterloo, Cities of Cambridge, Kitchener, and Waterloo, and the Townships of North Dumfries, Wellesley, Wilmot, and Woolwich. Recognizing our unique collaborative strength and innovative approaches to planning, the Federation of Canadian Municipalities awarded ClimateActionWR one of only thirteen 'Transition 2050' grants across Canada to support this work.

This local commitment and federal support led to the development of *TransformWR* — a comprehensive community strategy for transforming our region over the next 30 years.

HOW THIS STRATEGY WAS DEVELOPED

This work enabled us to think and plan differently than we had in the past—where we had worked only with the assets we had and towards goals that felt easily achievable. This time, we took a more ambitious approach, leveraging a backcasting methodology: a planning method that starts with defining a desirable future and then works backwards to identify the actions necessary to connect that future to the present. This meant looking to global, federal, and provincial targets, as well as other municipalities across Canada, to understand our local responsibility in the fight against climate change. That led us to defining our '80by50' target. Informed by our local community, we articulated a transformative vision for 2050, which our work would direct us toward achieving. With input from local, national, and global experts, the barriers, opportunities, and actions to get us to our vision were identified. From there, the elements were brought together to form our long and short-term plans.

DEVELOPMENT OF THIS STRATEGY INVOLVED 3 KEY PHASES:

PHASE 1

Starting with community engagement, we heard from more than 1600 community members across the entire region. Through events, workshops, interviews, focus groups, and surveys, we heard from members of our community about what they wanted the low carbon future of Waterloo Region to look like, and their insights on how we can get there. This work directly informed **Our Vision of 2050**, and the **Principles for Designing a Low Carbon Future**.

PHASE 2

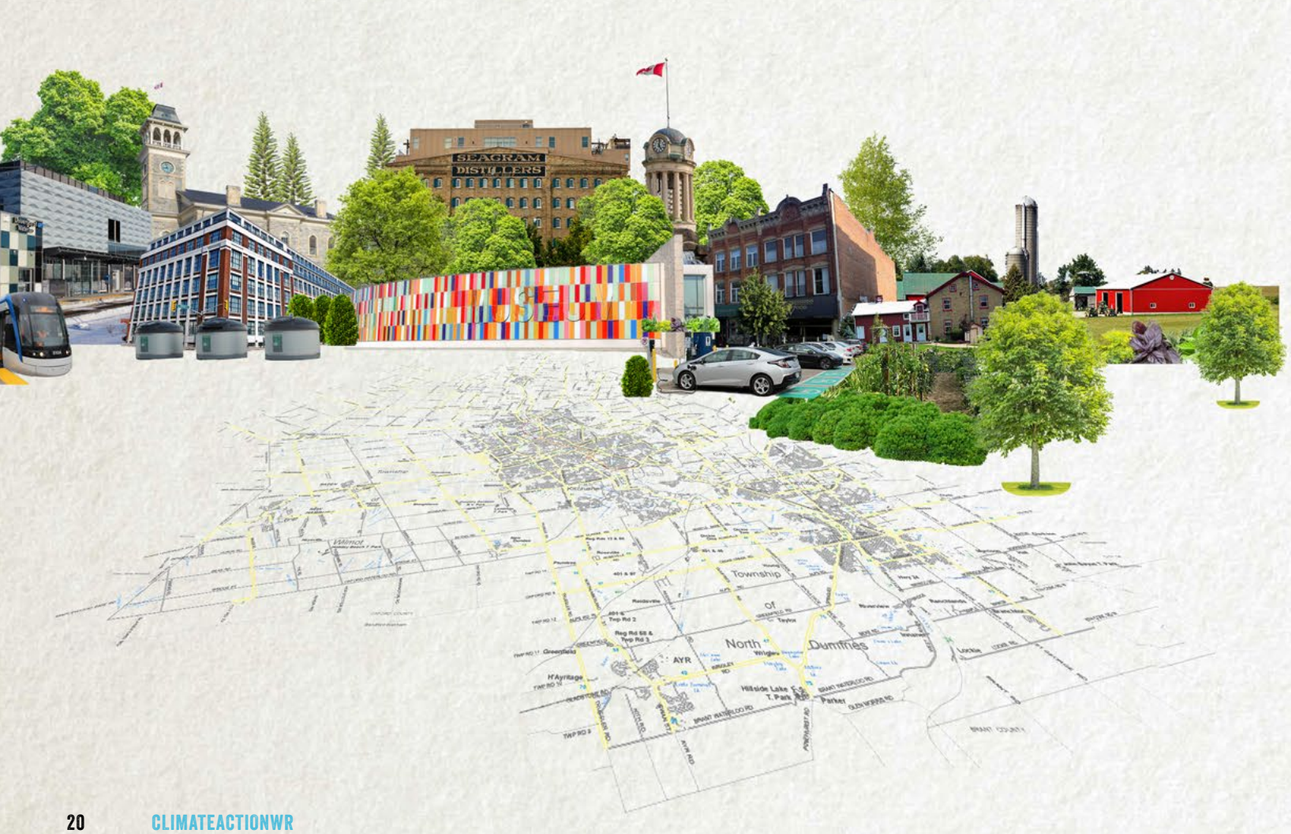
Through workshops, surveys, and conversations with over 100 technical experts, locally, nationally, and internationally, we learned about the existing and emerging solutions and technologies that could be leveraged to achieve our goal and vision.

PHASE 3

Based on both the community and technical data and insights, followed by cross sector collaboration, the pathway to guide our **Transition to a Low Carbon Community** was developed. Based on this pathway, we identified **6 Transformative Changes to create an Equitable, Prosperous, Resilient Low Carbon Community**. These are the six things we must change by 2050 to achieve our vision and meet our GHG reduction goals. For each **Transformative Change**, a set of strategies were identified, as well as the short-term action items used to inform our **10-year plan**.

Throughout the development of this strategy, ClimateActionWR participated in workshops on sustainability justice delivered by the Viessmann Centre for Engagement and Research in Sustainability (VERiS). Through this, we began our sustainability justice journey, to help ensure that an equity and inclusion lens is applied to this work, and will be a critical element of the implementation stages in the years to come. We acknowledge that we are at the beginning of this journey, and we will continue to take active strides to ensure equity and sustainability justice are a core focus of local climate action.

PART I: TRANSFORM^{WR} 30 YEAR STRATEGY



OUR VISION FOR 2050

Directly informed and inspired by what we heard from the community, what follows is the hopeful vision of what Waterloo Region will look, feel and operate like in 2050.

As a set, these statements reflect how the community sees GHG reductions integrated into other parts of a healthy region. If we transform the ways we move, the ways we build and operate our spaces, the ways we produce, consume and waste, and the ways we relate to one another, we will create a more equitable, prosperous, and resilient community. These statements give us a sense of how we'll know we've reached our goals—beyond the numbers. All of these statements reinforce one another. They work together illustrating *a web of benefits that enriches the entire community in ways far beyond meeting a GHG target*.

When reading them, imagine yourself standing in our community in 2050. It's not crystal clear and no one can predict every detail, but these vision statements describe glimpses of a future that is ours to create.

IN OUR VISION OF THE FUTURE...

OUR REGION IS A LEADER IN CLIMATE ACTION IN CANADA. AND PEOPLE ACROSS THE COMMUNITY TAKE PRIDE IN THIS.

Waterloo Region is a national example of a community that reorganized itself for the betterment of all life. People tell stories about how tackling climate change and exceeding GHG reduction targets was a challenge the region rose to, collectively. Our legacy continues to be one of innovation, of coming together, and of mobilizing around need. Our response to climate change and our active stewardship of our environmental home fuels economic prosperity, binds the community together and makes people want to live, work, and play in Waterloo Region.

WE'RE A COMMUNITY WHERE EVERYONE HAS THE OPPORTUNITY TO ACCESS AND MAKE SUSTAINABLE CHOICES.

We take pride in our collective action and we have a hopeful sense of what's possible because we lift everyone together. We have systems that are not just better for the same people, they're better for everyone, especially equity-deserving groups and those who were disadvantaged in the past. Beyond our region, we're known for the outcomes of our integrated approach to economic, environmental and social wellness. We're good welcomers and caretakers. People feel safe, seen, and cared for, and in turn take care of the land. Climate responsibility is second nature—an accessible default for everyone. We continue to make it convenient and financially accessible for people to act in a sustainable way, which reinforces sustainable lifestyles.

PEOPLE OF ALL AGES AND ABILITIES ARE MOVING AROUND THE REGION IN ACTIVE, CLEAN, CONVENIENT, ACCESSIBLE WAYS. AND OUR QUALITY OF LIFE HAS IMPROVED AS A RESULT.

We have a reliable network of mobility options, and safe, seamless infrastructure that supports active modes of transportation. We have reduced our reliance on fossil fuels and single occupancy vehicles to move us around the region. For trips that can't be taken using low carbon and active modes of transportation, electric vehicles are an affordable option and regional infrastructure supports their use. There are fewer parking lots, select car-free streets, and the region's arteries reflect a focus on moving people, rather than traffic. As our modes have become low-energy and low carbon, we see and experience other benefits that move us towards healthier families and community.

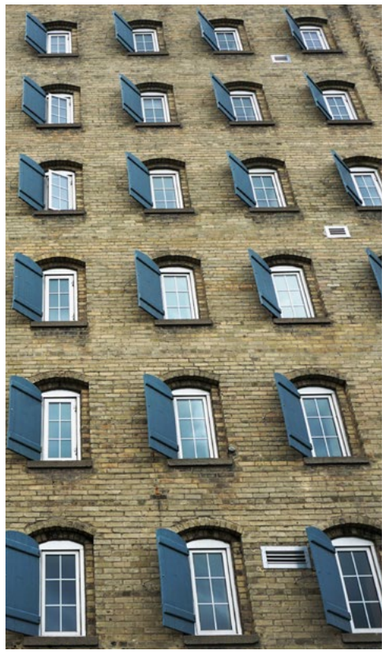
WE GROW MORE OF OUR OWN FOOD AND MAKE MORE OF OUR OWN ENERGY. AS A RESULT, WE'RE MORE CONSCIOUS OF WHAT WE NEED, WHAT WE USE, AND WHAT WE WASTE.

We participate in local food and energy systems. These systems are no longer hidden from view. People's practices and choices are influenced by this visibility—it's changed the way we produce, access, distribute, consume, and waste. Individual consumption habits are evidence of our focus on nourishment and need rather than excess and status. Our regional self-reliance makes us more resilient and adaptable to a constantly changing world.

THE HEALTH AND VITALITY OF OUR LOCAL ENVIRONMENT ARE ECHOED IN OUR PERSONAL WELLBEING.

There is momentum for environmental stewardship and we understand its link to whole community wellness—physical, mental and emotional. Climate-aware action is folded into the ways we take care of ourselves and each other. We're now seeing and feeling the ripple effects of lots of time spent outdoors, of an increased sense of safety and belonging in those spaces, and of balance. Movement throughout the region is primarily active, clean and shared, and fuels a holistic approach to personal health and the health of our relationships. The look, feel, and design of the region are evidence of this shift—we see it in our transitways, our gathering spaces, and the places between our destinations. Access to green spaces is available to all members of our community in a fair and equitable way.

WE GROW MORE OF OUR OWN FOOD AND MAKE MORE OF OUR OWN ENERGY. AS A RESULT, WE'RE MORE CONSCIOUS OF WHAT WE NEED, WHAT WE USE, AND WHAT WE WASTE.



LOCAL RESOURCES, PROVIDERS, SUPPLY CHAINS AND MINDSETS PROPEL OUR ECONOMY.

Economic prosperity has grown out of community wellness and environmental health—our primary measures of regional prosperity. The way we work and the way we live are integrated in healthy, sustainable, and equitable ways. Individual, isolated stories of winning are rare—the culture doesn't produce them nor does it see them as virtuous. What we have grown is our community security and connectedness. People feel cared for here—all people—and we in turn extend that care to the land. We shifted—knowingly or unknowingly—our desires. We strive for less material and wealth accumulation and more relationships and connectedness. This shift has changed our orientation towards ownership—of things, of property, of ideas—and fuelled economies of sharing and access. We've embodied the idea of thinking globally and acting locally.

OUR INFRASTRUCTURE IS A LIVING EXPRESSION OF NATURE'S RESILIENCE AND ELEGANCE.

Our infrastructure—old and new—is designed and built to connect people and the natural world. We see it in our choice of materials, in our expectations about performance, durability and impact, and in our practice and craft of engineering, planning, and design. The boundaries between "built" and "natural" worlds have softened. We see more green. We see more life. Vibrant urban forests and outdoor spaces support new relationships between people and the planet and perpetuate our awareness of, and action towards, reducing impact while ensuring resilience to a changing climate.

NEIGHBOURHOODS HELP PEOPLE MEET THEIR UNIQUE NEEDS AND THRIVE CLOSE TO HOME.

We've built and organized into a collection of complete neighbourhoods, each with a unique assortment of businesses and services meeting people's daily needs. We rely on each other, in part because we've recognized our individual limits. We look to nature for inspiration and are forming harmonies of urban, social and economic biodiversity. Connected, walkable, complete neighbourhoods encourage and sustain thriving micro-sharing economies. These economies promote strong relationships, accessibility, and diversity. In our neighbourhoods, all residents feel they belong and are valued. We're actively cultivating a sustainable legacy of localized production and consumption, and an increased sense of community, physical activity level, and connection to—and appreciation of—the natural spaces we live amongst.

WE ARE A COMMUNITY THAT KNOWS WE'RE NOT SEPARATE FROM THE PLANET.

We have a better understanding of our impact. We've evolved from using measures that focus predominantly on humans, to those that demonstrate concern for all life. We have succeeded at reducing our negative impact, and now we focus on having a positive impact. We act in ways that signal a deep awareness of interdependencies. With guidance from our elders, children grow up with an awareness of their part in a greater whole, and our learning institutions weave this mentality into their culture. With a sense of duty and responsibility, we are fulfilling our role within the greater ecosystems in ways that enable all life and all people to thrive.

PRINCIPLES FOR DESIGNING A LOW CARBON FUTURE

WHAT ARE PRINCIPLES?

Principles are a set of considerations for making decisions and setting priorities over time. They're a guiding light for aligning our intentions and actions, and articulate a framework that decisions should be evaluated against. They help to communicate the values we're working towards in our path to a low carbon community that is equitable, prosperous, and resilient.

Whether you are a citizen interested in taking climate action at home or in your neighbourhood, a new business, an educational institution, a faith community, a multinational corporation that calls Waterloo Region home, and whether you find yourself in a rural or urban setting, use these principles to guide how you take climate action, and implement your own actions and strategies to move us toward our goals.

As with the Vision and many other parts of *TransformWR*, these principles emerged from many conversations with members of this community.

PRINCIPLES:

PRIORITIZE IMPROVING THE WELLBEING OF, AND REDUCING NEGATIVE IMPACTS ON, EQUITY-DESERVING GROUPS.

The impacts of climate change disproportionately affect people who experience structural and systemic oppression. Often, these groups also benefit less from the solutions we create and, in some cases, may be further disadvantaged by them. Do the work to understand how a proposed change will affect these groups as well as future generations—not just the current majority—and insist that this understanding shapes future approaches and solutions.

TAKE AMBITIOUS ACTION NOW.

Think in the long-term, and act in the short-term. In doing so, we set ourselves up for not only achieving our targets, but overshooting them. Acting today, even if it seems small, is better than acting tomorrow.

IDENTIFY AND RESPOND TO GAPS.

Even the tiniest changes or unaddressed details can impact participation in a decision. Figure out what parts of systems aren't helping us meet our goals, and fix them. There are often unforeseen issues that arise after implementation. Stay focused, notice and address these ripple effects, and close any loops that may be unintentionally incomplete.

INVITE CONSTRUCTIVE CRITIQUE AND STAY OPEN TO DOING THINGS DIFFERENTLY.

Plan in ways that recognize uncertainty and multiple potential outcomes. Overconfidence in any one approach should prompt us to explore additional context and expand our conversations to generate more options.

DESIGN FOR ACCESS AND FACILITATE COMMUNITY OWNERSHIP.

Personal ownership can drive consumption and waste in the name of convenience and status. Instead, focus on maximizing usage—of spaces and products—and on minimizing down or idle time. Coordinate systems and incentives to support this kind of sharing.

MAKE IT EASY FOR ORGANIZATIONS AND INDIVIDUALS TO REDUCE THEIR IMPACT.

Make the most convenient and affordable options the most sustainable ones, and make climate-harming options difficult, inconvenient, costly, or inaccessible.

HELP PEOPLE SEE AND FEEL THEIR IMPACT.

We are feedback hungry creatures. Draw attention to the positive and negative impacts of action and inaction. Tell success stories, give people real-time feedback, and make evidence unmistakably obvious to inspire action.

MODEL RESPECTFUL CARETAKING OF, AND PARTNERSHIP WITH, THE NATURAL WORLD.

The way we treat the soil, water, and air eventually comes back to us. If we recognize and value all life around us, we are less likely to think of it as something to conquer, and more likely to nurture, replenish, honour and learn from it.

Pay attention to what metrics and measurements reinforce, and what they leave out.

Individual data points can be misleading in complex systems. They tend to tell partial stories. Take a step back and work to identify the other changes, benefits, risks and consequences associated with them.

SUPPORT EACH OTHER THROUGH THE CHANGE.

Everyone is at different places on their climate journey. Be mindful of what the change means for others and recognize resistance to change as an invitation to provide support. Listen to understand their challenges, meet people where they are, and help those who need support through the transition.

ENSURE 'IMPACT ON CLIMATE' IS A KEY DECISION MAKING FACTOR IN ALL DECISIONS.

Include climate at decision making tables. Make *awareness of impact* part of more conversations. Evolve to reduce our negative impact. Strive for positive impact.

Equity-deserving groups refer to members of society who experience barriers to equal access, opportunities and resources due to historical disadvantages and discrimination and are often underrepresented in key decision-making positions. These are groups that deserve recognition, a reduction in burdens, and fairer access to societal benefits. Groups that are actively seeking social justice and reparation are referred to as equity-seeking groups (Canada Council for the Arts, n.d.). The following are examples of relevant equity-deserving and seeking groups in the Canadian context: low-income, racialized groups, immigrants, people with disabilities, people experiencing homelessness, Indigenous groups (who are also seeking sovereignty in addition to equity), 2SLBGTQIA+, women, youth, seniors, refugees, and workers affected by green transitions.

What is your vision for Waterloo Region in 2050?

"We have a stronger sense of community because we appreciate and respect our home together." – *Waterloo Region community member*

TRANSITION TO A LOW CARBON COMMUNITY

Building on our community's vision for 2050 and the principles that will guide action moving forward, a 'GHG reduction pathway' was developed. This helps us understand the big changes our community needs to make over the next three decades to reach our targets and the speed at which they need to be made.

A key consideration in the development of this pathway was population growth. In 2020, Waterloo Region was named the fastest growing community in Canada[1], with forecasts expecting our region to grow to approximately 923,000 by 2051 (representing an increase of approximately 366,400 persons between 2016 and 2051)[2]. This makes emissions reductions even more challenging, as we need to decrease our overall emissions, not just our emissions per person.

With that in mind, the GHG reduction pathway is built on a model that examines three possible scenarios:

1. **Inaction**: Our population continues to grow as expected, but no further efforts are made to reduce our GHG emissions;

2. **Industry Trends**: Our population continues to grow as expected, and predicted industry trends help us reduce emissions per person over time; and

3. **80by50**: Our population continues to grow as expected, industry trends help us reduce emissions per person over time, and we make further conscious changes to meet our '80by50' reduction target.

Our '80by50' pathway uses GHG emissions projections for our electricity grid currently used by the Independent Electricity System Operator for Ontario. They presume that we will meet our increasing electricity needs using natural gas plants, and thus our emissions from electricity are expected to rise significantly over the timeframe of this strategy. Changes that reduce GHGs associated with electricity generation could make the actions and strategies in this pathway produce larger emissions reductions.

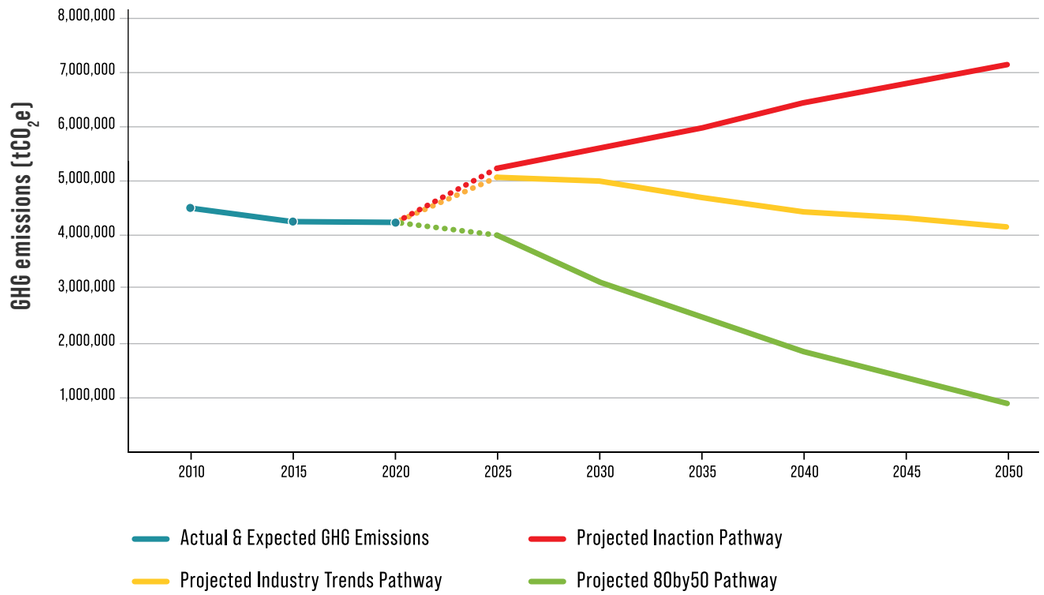


Figure 2: Actual and expected Waterloo Region total GHG inventories meeting the 3 projected pathways: inaction, industry trends and our '80by50' pathway with an interim 30% GHG reduction by 2030

This third scenario forms the '80by50' pathway, the technical model on which this strategy is based, and includes our interim '30by30' target (See Our Path to 2030 in Part II: TransformWR 10 Year Plan for more on why a '30by30' target has been selected). Based on this model, six Transformative Changes were identified to transform the ways we move, the ways we build and operate our spaces, the ways we produce, consume and waste, and the ways we relate to one another. If we make those six Transformative Changes over the next 30 years, we will have met our 80% reduction target and built an equitable, prosperous, resilient low carbon community that fulfills our vision.

1 *Statistics Canada. (2020, February 13). Canada's population estimates: Subprovincial areas, July 1, 2019. Retrieved from https://www150.statcan.gc.ca/n1/daily-quotidien/200213/dq200213a-eng.htm.*

2 *Region of Waterloo. (2020, December). Regional Official Plan Review.*

TRANSFORMING
OUR ENERGY AND OUR COMMUNITY

Human-generated GHG emissions can come from many different sources. Some sources include methane emissions from our landfills, and leaks from certain kinds of refrigerants in appliances or industrial processes. However, most of our GHG emissions come from our energy use. We burn fossil fuels to power cars and equipment, to heat and cool our homes, and heat our water. Even in our electricity system, which no longer burns coal to produce electricity, natural gas is burned to meet some of our electricity needs. In 2017, 82% of the GHGs emitted in Canada were emitted from the energy sector (combustion, transportation, and gas and vapours from industrial processes)[3] .

Locally in Waterloo Region, 94% of our 2015 emissions were produced by energy consumption and combustion in our three highest emitting sectors: transportation, workplaces, and homes.

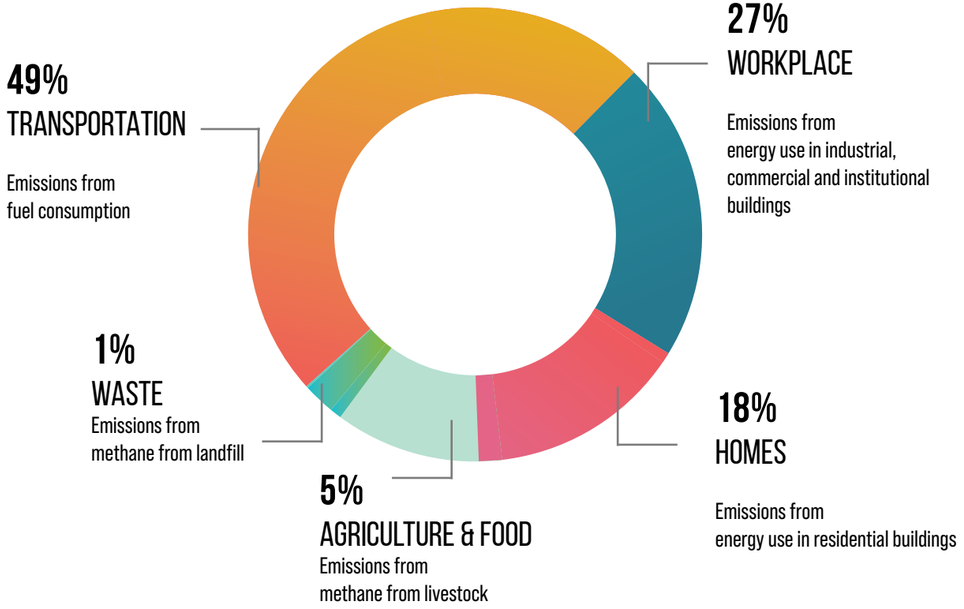


Figure 3: Waterloo Region's emissions breakdown by sector, from 2015 data

3 *Environment and Climate Change Canada. (2019, April 15). Canada. 2019 National Inventory Report (NIR) English. UNFCCC.*

Within these sectors, there are six primary energy/fuel sources that contribute to greenhouse gases:

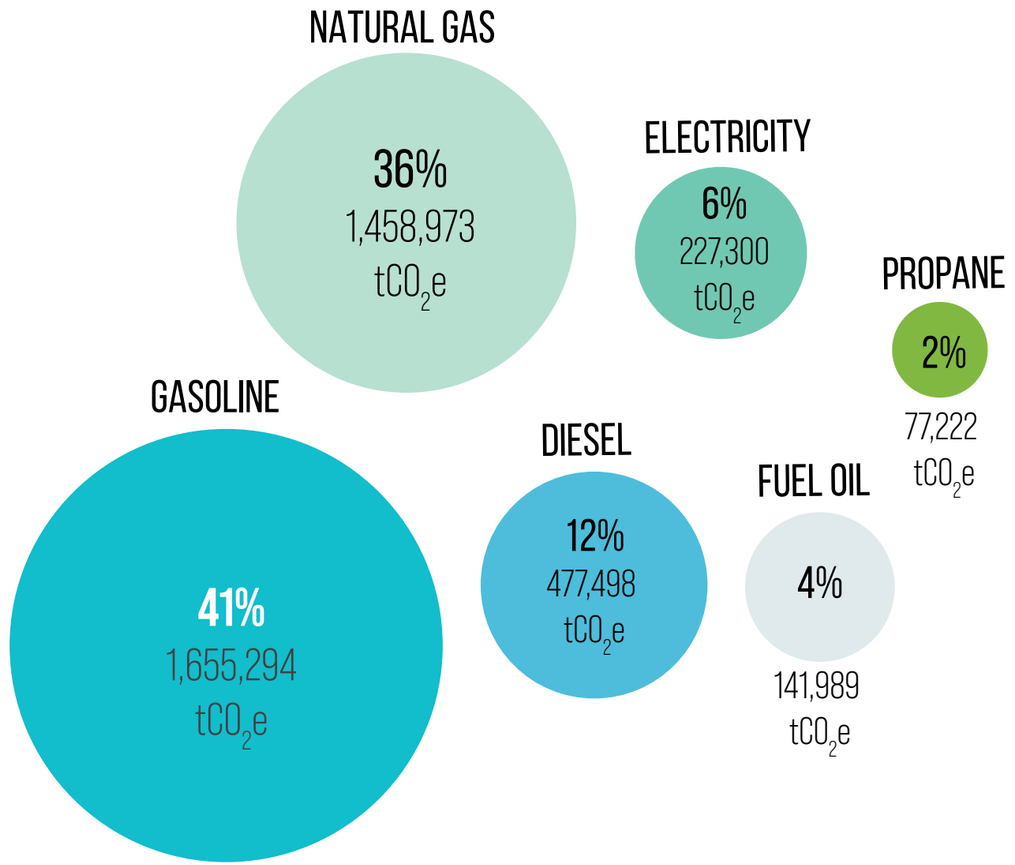


Figure 4: Waterloo Region's greenhouse gas emissions by energy source, based on 2015 data. tCO_2e refers to tonnes of carbon dioxide equivalent, it is a metric used to compare emissions from various greenhouse gases based on their global warming potential.

As a result, addressing our local emissions is primarily about changing our energy usage, and the systems that supply that energy.

3 APPROACHES TO REDUCING GHGS FROM ENERGY

There are three main approaches we can use to reduce GHG emissions from energy:

1) ENERGY CONSERVATION AND ENERGY EFFICIENCY: USE LESS ENERGY AND USE IT MORE EFFICIENTLY

In many cases, the most effective (and cost-effective) action we can take to reduce GHG emissions from energy is to use less, or to avoid using energy altogether. These are closely related.

Examples of reducing GHG emissions by reducing energy use include:

- Adding insulation to your building or home so that less energy is needed to maintain a comfortable temperature;
- Adjusting your building's temperature settings and dress code so that people can be comfortable with an extra degree or two hotter in the summer and colder in the winter; and
- Taking public transit or a small car instead of a truck or an SUV for your trip to the grocery store.

In many cases, it is possible to avoid using energy altogether. Examples of avoiding energy use include:

- Putting on a sweater or a blanket instead of turning on the furnace;
- Eliminating a car trip to the pharmacy by combining destinations and picking up your prescription at a location next to your grocery store; and
- Walking or cycling to work or to do errands instead of driving.

2) FUEL SWITCHING: USE CLEAN ENERGY

Fuel switching means transitioning from fossil fuels to low or zero carbon energy sources.

In most cases, this means using electricity to heat, cool, or move things. Electricity is the most versatile form of energy we have, as it can be used to power a vast diversity of mechanisms, from heating our homes and buildings to powering our vehicles. In some parts of Canada, electricity from the power grid produces considerable GHG emissions, as they still burn coal to produce electricity, however, in Ontario electricity is a very low carbon energy source. In 2019, 94% of Ontario's electricity was generated using emissions free sources[4].

Solar walls are a technology used to absorb solar heat and passively heat a building.

There are other ways of storing and transporting clean energy, such as the use of "green hydrogen," which is hydrogen generated using low carbon electricity. There are also opportunities to use and share heat energy in different ways, for example through the creation of **solar walls**, or between buildings in **district energy systems**.

4 *Transmission-Connected Generation. Ieso.ca. (2020). Retrieved from https://www.ieso.ca/power-data/supply-overview/transmission-connected-generation.*

Nevertheless, most fuel switching focuses on electrification.

It is possible to reduce emissions by changing one fossil fuel to another. For example, a home heated using fuel oil can produce more GHG emissions than a home heated using a natural gas furnace. However, to achieve our goals to significantly reduce emissions, fuel switching must in most cases focus on electrification and the elimination of emissions. Changes that simply use fossil fuels more efficiently can "lock in" GHG emissions for the life of the equipment, making it more difficult to make significant reductions in the future.

Instead of producing heat for space and water on-site (such as your furnace or hot water heater), **district energy systems** produce heat in a single location and use a network of insulated pipes to deliver hot water or steam to buildings. This is often much more efficient than individual on-site heat generation.

Sustainable home concept.

3) GENERATION: MAKE LOCAL CLEAN ENERGY

To address energy emissions at their source, we must transition to processes that generate energy without emitting any GHG emissions at all, such as solar power systems, wind turbines, **geo-exchange**, and **biofuels**. These are often referred to as renewable energy sources, which are created through natural processes that are replenished at a rate that is equal to or faster than the rate at which they are consumed.

Local renewable energy generation is an opportunity to:

- Provide affordable, reliable, clean energy to our community;
- Improve the systems that transport, store, and use energy;
- Increase local job opportunities;
- Keep more energy dollars in our local community;

Biofuels are an energy source made from organic matter or waste. They can be replenished quickly, and the organic matter captures carbon during its growth.

- Make our energy system more resilient and less vulnerable to external supply and fuel prices; and
- Explore different ownership structures that allow communities like ours, to find the best solution to our location and economic situations.

Through community energy planning, non-fossil fuel consuming micro-grids and district energy systems, energy efficient and low-GHG communities can be achieved. This often involves looking for new opportunities to store clean energy, so that it can be used on demand. Energy storage solutions are emerging technologies, with a range of options to suit diverse needs. The options continue to improve and evolve rapidly with new advancements.

Geo-exchange (ground-source heat pumps) is one of two types of heat pumps used for heating and cooling. Depending on the season, it transfers heat from the ground or water through a building, or transfers heat from a building back into the ground or water. Horizontal systems use shallow pipes in the ground over a large area. Vertical systems, which use pipes drilled deep into the earth, can be used in some locations where it will not disrupt our groundwater.

USING LESS ENERGY, USING CLEAN ENERGY, MAKING LOCAL CLEAN ENERGY

These three approaches – conservation, fuel switching, and generation – all work best when used together.

Energy conservation supports fuel switching, as using less energy means that more options are available to supply the lower amount of energy. Since the energy needs are less, fuel switching is often more affordable. Energy conservation also means that locally generated energy, either at your home or business or in larger industrial settings, can fill more of our energy needs.

Fuel switching to electricity enables equipment to run on locally generated renewable energy. In many cases, fuel switching also helps with energy conservation. This is because the use of fossil fuels is often inefficient, and much of the energy escapes as heat. Therefore, less energy is required to power an electric car than a gasoline car.

As a result, transforming Waterloo Region requires us to use less energy, use clean energy, and make local clean energy, which is a core focus of the 6 Transformative Changes we as a community need to make. The model shows that these energy changes will contribute the following GHG reductions compared to the ‘Inaction’ scenario:

Change Initiatives	2025	2030	2035	2040	2045	2050
Building Upgrades	148,612	288,256	415,904	561,262	761,851	944,739
Building Use Optimization	83,488	169,108	246,097	346,219	483,696	639,858
Fuel Switching	361,446	482,374	690,327	876,131	971,785	1,100,578
Net-zero Electricity Generation	20,208	40,640	59,904	94,078	139,850	204,844
Reduced Travel /Active Transit	174,980	330,833	690,588	888,199	1,045,630	1,182,572
Electric Vehicles	464,882	1,190,617	1,396,309	1,819,941	2,029,046	2,179,487

Table 1: The emission reduction effect (tCO_2e) of each method by year. The cumulative results of these initiatives move Waterloo Region away from the Inaction pathway and toward our '80by50' pathway goal.

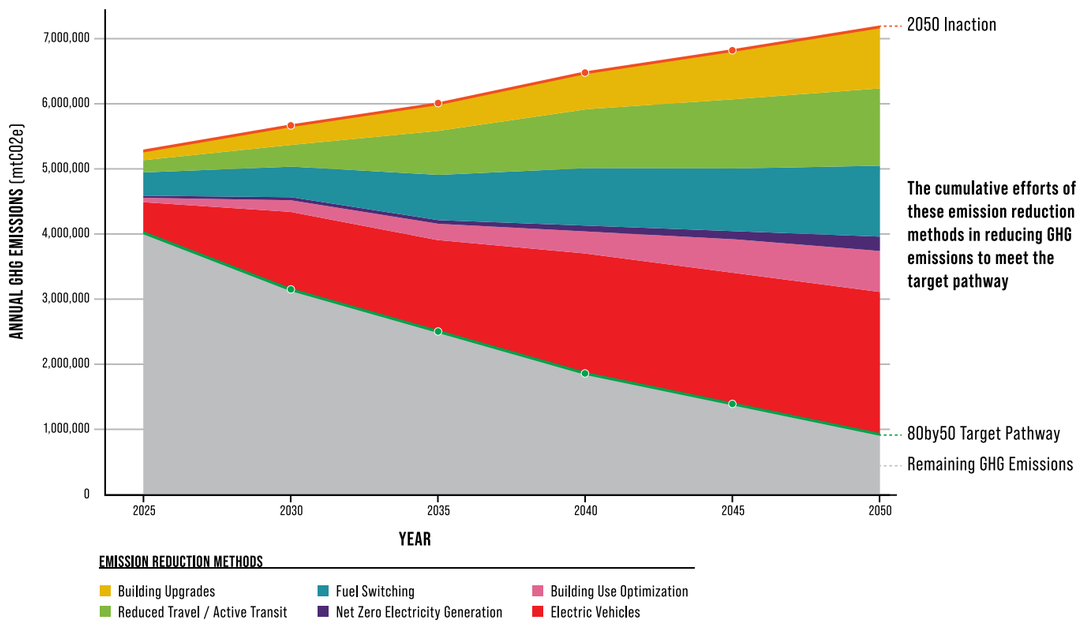


Figure 5: Effect of emission reduction methods on diverting our GHG emission pathway from the inaction trajectory to our '80by50' pathway.

Because existing industry trends are expected to contribute to these changes, the local work that must be done on top of those industry trends is expected to result in this portion of the emissions reductions:

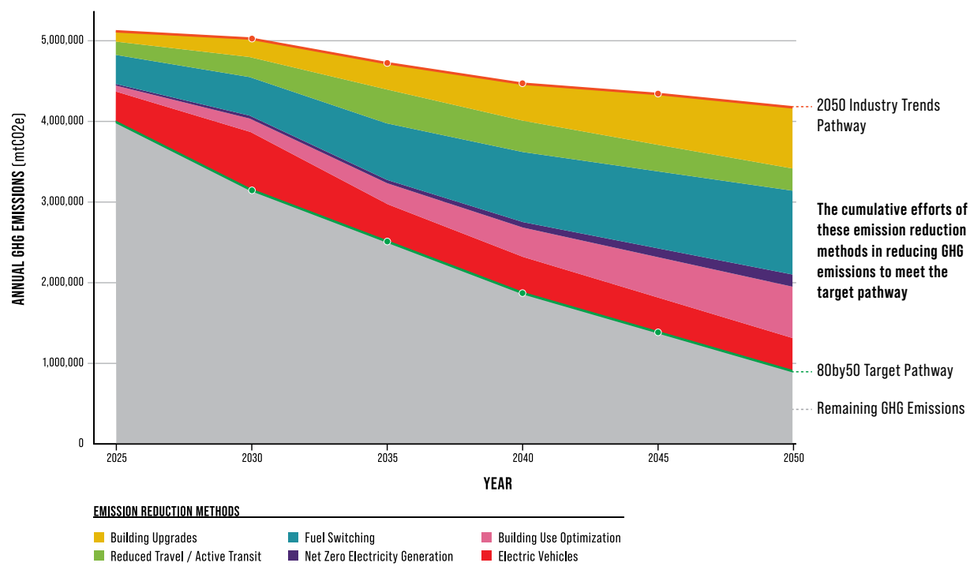
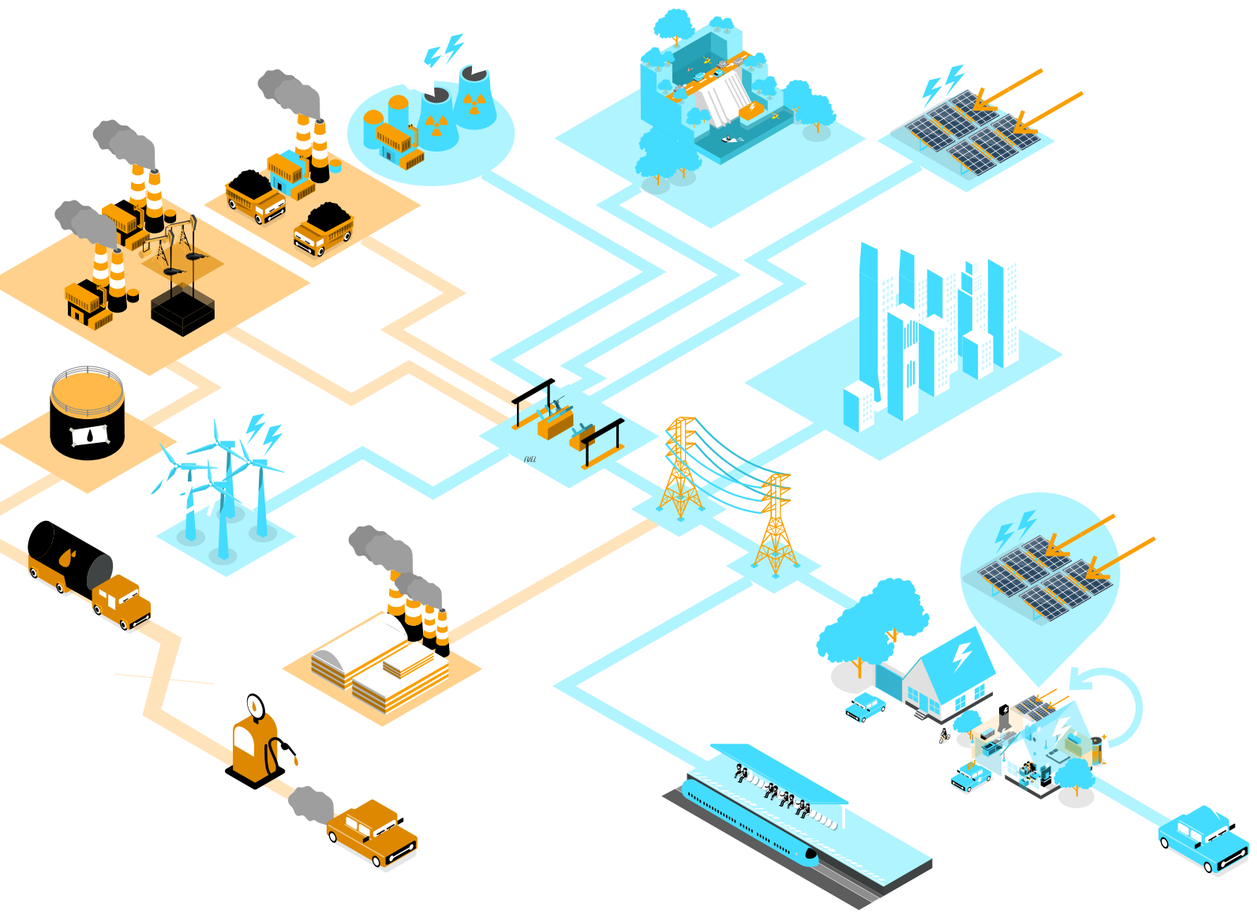


Figure 6: Effect of emission reduction methods on diverting our GHG emission pathway from the industry trends trajectory to our '80by50' pathway.

SIX TRANSFORMATIVE CHANGES TO CREATE AN EQUITABLE, PROSPEROUS, RESILIENT LOW CARBON COMMUNITY



We often talk about sustainability as a three-legged stool. Environmental sustainability is one leg, but the other legs are social justice and economic prosperity. Without one of the legs, the stool collapses. Likewise, the actions we take to address climate change must work to make our community more equitable and support the most vulnerable. Through this work, we can provide a solid basis for Waterloo Region to thrive in a global low carbon economy.

LOCAL ACTION

To meet our goal, we must first act locally, reducing the emissions generated within Waterloo Region that are measured in our local GHG inventories. We cannot address climate change without changing our behaviours on a daily basis by how we live, move around, and provide for ourselves. Through community collaboration, supporting change and acting locally will allow everyone to both participate in climate action, and benefit from the outcomes.

ADDRESSING OUR IMPACTS OUTSIDE OF WATERLOO REGION

While local action is our first priority, we also need to reduce our climate impacts outside Waterloo Region. Our GHGs don't end at our borders. While we are only able to fully monitor emissions created within the region, we know that the energy used to produce and transport our consumer goods, food, and building materials, and deal with our waste produce GHGs. Therefore we are each responsible for creating emissions in other jurisdictions to support our lives and businesses. To address these, we must make changes to our purchasing habits, understand where we source our goods from, and include GHG emissions as a primary decision making factor in our daily choices.

To fully do our part to contribute to a low carbon world, we need to reduce the energy used to support our lifestyles. This means transforming the ways we move, the ways we build and operate our spaces, and the ways we produce, consume and waste. We also need to transform the ways we relate to one another. Sustainability cannot be achieved without participation from everyone, meaning our transition must be equitable and support those who need it most through the transition.

In what follows, we identify four calls to action that result in six Transformative Changes to reduce our climate impacts locally and beyond, to transition to an equitable, prosperous, resilient low carbon Waterloo Region. We each have a role to play in making these changes, whether it be at the individual, business and organization, community, or municipal level. In what follows, many of the strategies associated with the Transformative Changes are at the systemic level, and will be brought to life through the agency and influence of our local municipalities. While municipalities are not the only stakeholders responsible for transformative climate action, the activities within their reach will significantly propel us toward success. The short-term action items associated with the systemic level changes are found in Part II: TransformWR 10 Year Plan.

As community capacity builders, businesses and organizations, and individuals, the *Principles for Designing a Low Carbon Future* are intended to guide the development of your own strategies and actions. For each Transformative Change, we provide examples of actions based on the principles. If you're stuck for how you can take action- refer back to the Principles.

TRANSFORM THE WAYS WE MOVE

TRANSFORMATIVE CHANGE #1: BY 2050, MOST TRIPS ARE TAKEN USING ACTIVE TRANSPORTATION, WITH THE SUPPORT OF A ROBUST PUBLIC TRANSIT SYSTEM.

Active transportation means any method of travelling to a destination that uses primarily human power, which we describe here as "walking, cycling, or rolling." This includes trips made using, or propelled, by your body, a mobility device, a bicycle or tricycle (with or without assistance from an electric battery), a skateboard, or a scooter.

In 2015, nearly half (49%) of our community's GHG emissions came from how we move people and goods. Furthermore, short distance trips of less than five kilometres make up nearly 50% of all travel by residents within the Region[5] that could generally be achieved using active forms of transportation.

Existing short trips need to be made by walking, cycling, or rolling. Longer trips, where possible, need to be replaced by shorter trips. For example, instead of driving to a grocery store across town, more people will walk, cycle, or roll to a store nearby.

Public transit service is crucial for making most trips using active transportation. It gives people a low-energy, convenient option for trips that they can't walk, cycle, or roll to. It supports being able to live fulfilling lives without owning a vehicle and is accessible to people of different incomes and abilities. In this way, a robust transit service needs to be used to supplement our active transportation goals.

KEY SUCCESS METRICS:

To make this Transformative Change, we need to make fewer trips, make shorter trips, and make lower energy trips. Of the reductions we've committed to make by 2030, these changes are expected to accomplish 13% of that amount. Of the reductions we've committed to make by 2050, these changes are expected to accomplish 19% of that amount. This is compared to keeping our energy use patterns the same as 2010, as our population grows. More specifically, we expect that specific reductions in transportation energy use will be made in these ways:

Results	2030	2040	2050
Make fewer trips: Reduction in travel between homes and workplaces due to work from home options (% reduction in vehicle trips to workplaces)	10%	30%	40%
Make fewer trips: Reduction in discretionary trips (% reduction in vehicle distance travelled for discretionary trips)	4%	14%	18%
Make shorter trips: Reduction in trip length (% reduction in vehicle distance travelled, for trips over 5km)	2%	6%	10%
Make lower energy trips: Replacing personal vehicle use for trips under 5km by using active transportation (% of existing short vehicle trips switched to walking, cycling, or rolling)	10%	40%	80%

"CycleWR is pleased to be partnering with ClimateActionWR and regional municipalities to make cycling a safe, convenient and respected option for all who can take advantage of this healthy and climate-friendly transportation option. We see community active transportation hubs as one important tool to make this choice more accessible and attractive. A key focus is to ensure that equity-deserving communities are included in our support and outreach."
– David Trueman, Steering Committee, CycleWR

5 *Region of Waterloo. (2019, June). Moving Forward - 2018 Transportation Master Plan. Retrieved from https://www.regionofwaterloo.ca/en/living-here/resources/Transportation-Master-Plan/DOCS_ADMIN-3030800-v3-TMP_Report_Moving_Forward_Main_Report_FINAL_2019-06-12.pdf*

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 1.1: Redesign, rebuild, and maintain our transportation system to prioritize active transportation.

While significant work has been undertaken to support choice in transportation modes, the current transportation system still largely focuses on moving personal vehicles that require large amounts of energy. That focus needs to shift toward low or no energy ways of providing mobility.

To do this, we need to redesign and rebuild our entire mobility system to put active transportation first, making facilities for walking, cycling, and rolling the first priority on our roads and trails. This redesign process will need to address current challenges, such as ensuring that the system serves people of all ages and abilities and in all weather conditions and times of day. Doing so will make moving around the region easier, more affordable, safer, healthier, and more energy efficient.

Spotlight on Climate Justice: Affordability is a key factor in making our transportation system equitable, low energy, and low carbon. This means making low-cost options like walking, cycling, rolling, and transit the easiest choice to meet daily needs. It also means making sure that everyone can access what they need to use these systems, like low-cost bicycles and transit passes for low-income community members.

Strategy 1.2: Continue to build a robust and accessible public transit system that conveniently and safely serves people across the community.

While our whole transportation system has to change to put active transportation first, public transit needs to be prioritized, as well. This allows people to take trips to places they can't walk, cycle, or roll to, using an energy efficient means of transportation. This will also serve to better connect people from across the entire region, and provide sustainable transportation options across both cities and townships.

Spotlight on Climate Justice: Developing our transportation systems in rural parts of the region is an important component of making low and no emission travel accessible to all. Transportation and land use planning in both urban and rural communities, and applying these approaches in context-sensitive ways that meet diverse needs, is essential to reducing our emissions.

Strategy 1.3: Support people to walk, cycle, or roll, and build a culture of active transportation and public transit ridership.

Enabling people to build their lives around active transportation and/or public transit instead of personal automobile travel has a number of community benefits. It will not only contribute to reductions in local GHG emissions, but will increase community wellbeing and physical activity, and decrease air pollution that causes adverse health effects. Surveys have shown that there are large segments of the population who are interested in increasing their active transportation, however, safety concerns and other barriers such as transporting goods, access to equipment, and social norms stop them [6,7]. People must be provided with tools and resources to support changing the way we move around.

Strategy 1.4: Transition to low energy movement of commercial goods.

Movement of goods is essential to Waterloo Region's strong business, manufacturing and industrial sector, and so people can meet their daily needs. Locally this ranges from auto parts heading to major manufacturing plants, supplies destined to offices in urban centres, distribution of food and consumer goods, movement of aggregate resources, and heavy trucks moving along our highways destined for other markets. Goods in Waterloo Region are currently primarily moved by large trucks, but also using freight by rail on the CP and CN rail lines. In order to significantly reduce GHGs associated with transportation, we must support a transition toward efficient, low energy methods of moving commercial goods.

Strategy 1.5: Build compact urban and settlement areas that are efficient for energy, services, infrastructure, and transportation, and make existing and new communities "complete communities."

The amount of energy it takes to get around our communities depends heavily on the way they are built and designed. We can improve efficiency by planning and creating more complete communities, where goods, services, and employment can be reached conveniently by walking, cycling, or rolling. Emissions from conventional vehicles are also reduced as a result of less distance travelled. These are also known as "15-minute communities." More compact communities that use less energy for transportation help us use less energy to provide services and build infrastructure, further reducing emissions. This must be a key consideration for land use planning.

A **15-minute community** is where people can meet their daily needs for goods, services, and employment using active transportation, within a short walk, bike ride, or roll.

6 *Ontario Ministry of Transportation. (n.d.) 2016 Transportation Tomorrow Survey results for Region of Waterloo.*

7 *ClimateActionWR. (2020). ClimateActionWR 2020 Active Transportation Survey.*

COMMUNITY CAPACITY BUILDERS ARE ORGANIZATIONS OR GROUPS THAT PROVIDE RESOURCES AND SUPPORT TO OTHER ORGANIZATIONS OR COMMUNITY MEMBERS. THIS CAN SOMETIMES INCLUDE CERTAIN COMMUNITY GROUPS AND VOLUNTEER GROUPS.

Toyota plans to phase out 90% of gas vehicles by 2050 and GM plans to only build zero emission light-duty vehicles by 2035.

Take action in every part of your life, to ensure that by 2050, most trips are taken using active transportation. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

Community Capacity Builders

- Create welcoming spaces (hubs) that provide support and tools to help people choose active transportation
- Expand and innovate programming to support employers to provide resources and services that make sustainable transportation the easy choice
- Develop educational resources and provide access to mobility options, such as bike libraries and community bike lending

Businesses & Organizations

- Develop 'work from home' policies
- Make your office conducive to active transportation: Install employee showers, secure bike/scooter storage, bike share stations, etc.
- When locating or relocating, select sites that can be easily accessed using active and public transportation systems

Individuals

- Commit to walking, cycling, rolling and public transit for all destinations within 5km of your home
- Group errands together to reduce the number of trips you need to take

Green hydrogen is a clean burning fuel that uses renewable energy to split water into its component elements of hydrogen and oxygen. It has several applications including as an energy source for vehicles.

TRANSFORMATIVE CHANGE #2: BY 2050, REMAINING PERSONAL AND COMMERCIAL VEHICLES ARE ZERO EMISSION VEHICLES.

While most trips will be made using active transportation by 2050, many trips will still require powered vehicles. This includes public transit vehicles, and personal and commercial vehicles. This is especially the case for rural parts of Waterloo Region where active transportation is constrained by long distances, and there is limited access to public transit. All remaining vehicles in 2050 must be zero emission vehicles.

Electric vehicles (EV's) are zero emissions, and are already available to consumers. Most major auto manufacturers are already producing electric models, and many automobile manufacturers such as Toyota and General Motors have announced dates by which they will phase out gasoline powered vehicles. While some types of industrial and commercial vehicles may need to use other zero emissions technologies like **green hydrogen**, with strong investments in charging infrastructure, the future of most vehicles is electric.

KEY SUCCESS METRICS:

Without further intervention, we estimate that market trends will mean approximately 20% of vehicles in Waterloo Region will be zero emission vehicles by 2030. To achieve our target of reducing overall emissions by 30% by 2030, we will need to show leadership and go farther, converting half of vehicles on the road to zero emission vehicles in the next decade. Of the reductions we've committed to make by 2030, switching to zero emission vehicles is expected to accomplish 47% of that amount. Of the reductions we've committed to make by 2050, switching to zero emission vehicles is expected to accomplish 35% of that amount. This is compared to keeping our energy use patterns the same as 2010, as our population grows.

Results	2030	2040	2050
Gasoline and diesel vehicles switched to zero emission vehicles (% of vehicles that are electric)	50%	80%	99%

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 2.1: Switch personal and commercial vehicles to zero emission vehicles.

Global commitments to electric vehicle production, and regulations phasing out combustion engines, will heavily contribute to this shift, but ultimately we must act locally to ensure we are replacing personal, commercial, and fleet vehicles with EV's steadily over the next

30 years. Supporting this shift will include completing Waterloo Region's electric vehicle strategy, providing local motivation and incentives, and public outreach to increase our local awareness.

Strategy 2.2: Build a network of charging/refuelling infrastructure to support the shift to zero emission vehicles.

To support our community's transition to zero emission vehicles, we must simultaneously build our charging and refuelling infrastructure. We must work now to prepare for our short-term needs, but more importantly, build for the long-term visions we are planning to support. This means a future where the majority of parking spaces, both public and private, will require charging infrastructure. Providing public charging and refuelling infrastructure, supporting businesses in providing access for their customers and employees, and aiding individuals to support their own transitions are all critical elements of this work.

Another key element of building this network will include further exploration outside of electrification options, into alternative zero emission vehicle options and their required refuelling methods, such as green hydrogen.

Take action in every part of your life, to ensure that by 2050, remaining personal and commercial vehicles are zero emissions vehicles. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

COMMUNITY CAPACITY BUILDERS

- Develop resources to support organizations and individuals in their decisions to switch to zero emission vehicles

BUSINESSES & ORGANIZATIONS

- Begin replacing fleet vehicles with electric alternatives
- Install electric vehicle charging stations at your office
- Install electric vehicle charging stations at multi-unit residential buildings

INDIVIDUALS

- If you own a vehicle, consider electric if and when you need to replace it
- If you are knowledgeable about zero emission vehicles, share your stories and learnings with your friends and networks

TRANSFORM THE WAYS WE BUILD & OPERATE OUR SPACES

TRANSFORMATIVE CHANGE #3: BY 2050, BUSINESSES AND HOMES NO LONGER USE FOSSIL FUELS FOR SPACE HEATING AND COOLING, AND WATER HEATING.

45% of our local GHG emissions in 2015 came from energy used in buildings. Most of this is from natural gas or other fossil fuels used to heat our workplaces and homes, and provide hot water.

Space heating in most of the homes and businesses in Waterloo Region currently comes from natural gas. HVAC equipment, such as furnaces and boilers, transfer heat generated from the natural gas combustion to air or water, which is distributed throughout the building to provide space heating. In the average Canadian home, the hot water heater uses nearly a fifth of a home's total energy from all fuel sources[8]. Switching off of fossil fuels for heating and cooling needs in businesses and homes is one of the most impactful changes we can make to reduce GHG emissions locally.

We must address fuel switching while increasing energy efficiency in the buildings that already exist, as well as set expectations for how new ones will be built.

KEY SUCCESS METRICS:

To achieve this Transformative Change, we need to convert our buildings off of fossil fuels, while also building and retrofitting them to be more efficient in the first place. Of the reductions we've committed to make by 2030, these changes are expected to accomplish 38% of that amount. Of the reductions we've committed to make by 2050, these changes are expected to accomplish 43% of that amount. This is compared to keeping our energy use patterns the same as 2010, as our population grows.

Results	2030	2040	2050
Buildings using electric heat pumps, or equipment that is at least as energy efficient and low carbon as electric heat pumps, instead of natural gas (% of buildings with heat pumps, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric heat pump)*	20%	60%	85%
Buildings using energy efficient and low carbon water heaters instead of natural gas (% of buildings with electric water heaters, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric water heater)	20%	60%	85%
Reduction in fuel oil and propane use	100%	100%	100%

8 *Government of Canada. (2020, November 27). Heating equipment for residential use. Retrieved from https://www.nrcan.gc.ca/energy-efficiency/products/product-information/heating-equipment-residential-use/13740*

*For equipment to be energy efficient and low carbon enough to be consistent with this strategy, the new equipment installed or fuel sources used, must be at least as efficient as an electric heat pump. This means it must have a “coefficient of performance” (COP) of three. It must also not produce more emissions than an electric heat pump would, meaning that the direct or in-direct carbon emissions factor associated with the source energy must be equivalent to or less than the current (at the time of equipment replacement) Ontario grid blended carbon emissions factor.

The Coefficient of Performance (COP) for heating and cooling equipment is found by dividing the power output of the equipment by the power input, both in KWh. The higher the COP, the more efficient the equipment is.

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 3.1: Decarbonize building heating and cooling, and water heating, by replacing furnaces and hot water heaters with highly energy efficient and low carbon equipment or fuel sources.

Because they are proven, commercially available, and highly efficient, electric heat pumps are a critical part of our community’s path to ‘80by50’. This is especially true in the next decade, since we need to start now to rapidly scale existing technology to make significant emissions reductions by 2030. Installing an electric heat pump is a step that can be taken right now to transition a building off of fossil fuels.

Electric heat pumps are inherently very efficient systems because they move heat rather than generating heat. Just like a fridge, these systems use refrigerants that absorb heat in one location and deliver it in another through the use of condensers. Modern heat pump water heaters (HPWHs) are capable of generating all of the hot water needs of a residential home much more efficiently than conventional water heaters.

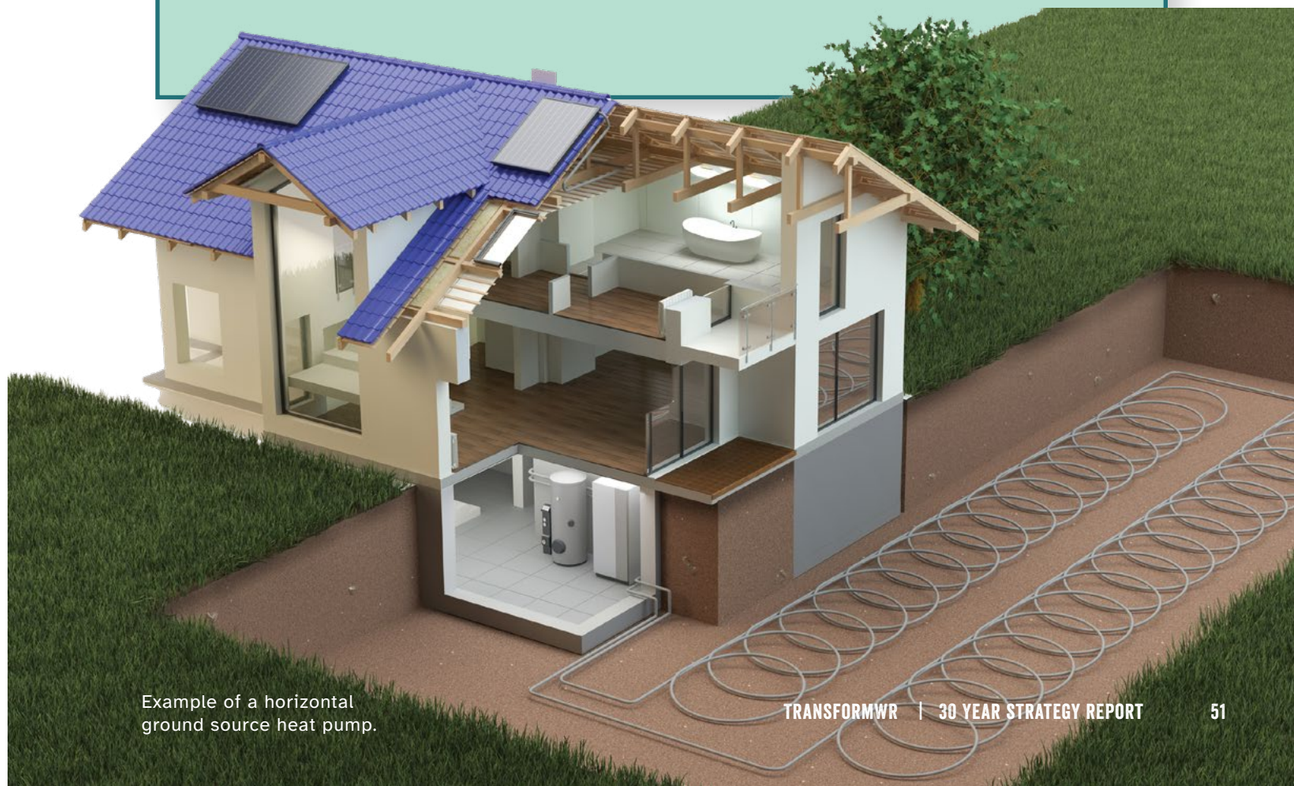
In the longer term, other non-fossil fuel options are expected to play an important role in our energy transition. This includes the potential to use a mix of renewable natural gas and green hydrogen to fuel some equipment that currently runs on natural gas, or to power energy-intensive activities like industrial operations.

Innovative financing options, including public and private partnerships can play an important role in attracting investors, and raising and mobilizing capital to scale up energy retrofits. Many solutions should be explored locally, to build up the retrofit industry and enable our community to achieve our climate goals.

9 *McDiarmid, H. (2020, October). Analysis of the Residential Electrification Potential for the Waterloo Region. McDiarmid Climate Consulting. Retrieved from https://wrclimatechange.weebly.com/uploads/1/3/0/1/130157067/electrification_report.pdf*

Fuel switching off of natural gas for space heating and cooling, and water heating, significantly reduces GHG emissions. Of course, fuel switching is best accomplished with additional efficiency upgrades, like insulation, that reduce total energy needs.

Electric heat pumps are a proven and reliable heating and cooling technology in Canada. There are two main types:
Air-Source are the most common, drawing heat from outside air during the heating season and rejecting heat outside for cooling. These allow adequate heating even during cold weather.
Ground-Source use the earth, ground water, or both as the source of heat in the winter, and as a reservoir to reject heat from the home in the summer. These are less common. Some of these applications require drilling deep holes, and can only be used where they will not disrupt our groundwater.
Electric heat pumps are capable of being far more efficient than other heating equipment. One unit of energy going into a heat pump can result in an average of three units of heat energy moved into or out of a building. For systems that rely on burning fuels, only a fraction (60-95%) of the fuel energy is converted to usable heat energy[9].



Example of a horizontal ground source heat pump.

Strategy 3.2: Build new buildings to be net-zero carbon, or build to transition to net-zero carbon.

Since most buildings are built to last, the choices made while constructing a building will affect energy needs in the community for decades to come. Constructing net-zero carbon buildings that don't use fossil fuels, is easier than changing existing buildings to meet those standards. Therefore, when a new building is built, it needs to be designed to be highly efficient right from the start. However, the amount of carbon used in the building process and creating the building materials can be so significant that it takes decades to pay it back in operational carbon savings.

'Embodied Carbon' is a measurement of the carbon used in the manufacturing and transport of a good or service, before it is even used. This includes carbon emitted into the atmosphere during the growth, mining, extraction, harvesting, transport, manufacturing, and distribution of materials.

'Net-zero emissions' and 'carbon neutrality' refer to achieving an overall balance between GHGs produced and GHGs reduced or offset by renewable energy.

A net-zero carbon building is designed to be highly energy efficient, is made from low emission building materials, and contributes no net emissions from its operations by using zero emission renewable energy.

Policies that support sustainable building standards for new builds are critical to ensuring we meet our GHG reduction targets. This includes looking at the entire lifecycle of our buildings to address GHGs in the materials we use and where we source them. This applies to the development of all forms of homes (townhomes, multi-unit residential buildings, rural and urban single-family homes, etc.) and all industries/sectors (small business, commercial, education, industrial, healthcare etc.). This also presents opportunities to use planning development review processes to support and integrate net-zero carbon buildings into future developments.

Spotlight on Climate Justice: It is especially important that new buildings intended to serve lower-income community members be built to net-zero or net-zero ready standards. This ensures that people across the community have access to comfortable homes with lower utility bills for the long-term. The use of heat pumps in these buildings is especially important as extreme heat increases due to climate change, since heat pumps provide cooling as well as heating, and can help protect community members who experience high levels of vulnerability from extreme weather events.

Take action in every part of your life, to ensure that by 2050, businesses and homes no longer use fossil fuels for space heating and cooling, and water heating. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

COMMUNITY CAPACITY BUILDERS

- Create resources to educate building and home owners on the benefits of switching to electric heating systems
- Identify supports and incentives to help building and home owners afford retrofits for fuel switching

BUSINESSES & ORGANIZATIONS

- Investigate options for switching your building's heating systems from fossil fuels to electric
- Have a professional conduct an energy audit of your building, and make energy efficient upgrades

INDIVIDUALS

- Switch your space and water heating from natural gas to electric systems
- Have a professional conduct a home energy audit to learn how you can make your home more energy efficient
- Make energy efficiency a priority decision making factor when moving to a new home

TRANSFORM THE WAYS WE PRODUCE, CONSUME, AND WASTE

TRANSFORMATIVE CHANGE #4: BY 2050, WATERLOO REGION USES LESS, WASTES LESS, AND NO LONGER DISPOSES OF ORGANIC MATTER IN LANDFILLS.

Waste has significant consequences for GHGs. When organic material is disposed of in landfills, they break down into methane, which is 25 times more damaging to our climate than carbon dioxide. We account for some of that methane in our community inventory, but this only reflects what has been landfilled at our local public landfills (residential waste that is collected through the Region's curbside collection program).

Waste from businesses and multi-residential buildings with more than six units is arranged and paid for privately, without involvement from the Region or Area Municipalities. Much of this commercial waste leaves the community and is sent to landfills elsewhere. Since this process is arranged by landlords, condominiums, and businesses, we do not know how much waste is produced locally, where it goes, or whether GHG-emitting organics have been removed before the waste is landfilled.

Additionally, and what we cannot fully account for locally, is the energy used in making the things that we consume, and transporting it to us and eventually to the landfill or recycling centre.

Reducing our energy use and reducing our energy emissions relies on us using less, and building a circular economy (using items as long as possible, extracting the maximum value from them, and recovering, repurposing, and/or regenerating new products).

KEY SUCCESS METRICS:

In our pathway to '80by50', we assume that we will maintain the same level of methane emissions from our landfills as we had in 2010. This is because much of the emissions from our landfills are the result of organic material that was added to them years or even decades ago. Moving forward, we need to stop landfilling organic matter altogether. Success in achieving this Transformative Change will require us to make significant changes to what and how we consume across our community.

Results	2030	2040	2050
Maintain the same level of methane emissions from our landfills as we had in 2010 tCO_2e = tonnes of carbon dioxide equivalent. It is a metric used to compare the emissions from various greenhouse gases on the basis of their global-warming potential.	45,774 tCO_2e	45,774 tCO_2e	45,774 tCO_2e

"At Ekko, we're excited to be a collaborating organization on the Community Climate Action Strategy to reduce takeout waste in Waterloo Region, and create a circular economy through our reusable takeout container service."
– *Chloe & Crystalle Kruis, Co-Founders of Ekko*

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 4.1: Optimize the use of existing waste management infrastructure, including expanding diversion programs and energy capture from waste.

Residential curbside waste collection, diversion, and disposal services are delivered by the Region of Waterloo, servicing residents of the Area Municipalities. The Region has made great strides in waste management, expanding collection programs to reduce waste going to landfill, and shifting to every other week residential waste collection schedules to encourage waste reduction, recycling, and organics composting. From 2013 to 2019, green bin collection increased by 17 kilotons/year and residential garbage collection was reduced from 93 to 65 kilotons/year. Overall waste diversion rates have also increased, from 52% in 2011 to 65% in 2019[10].

Did you know?
After the transition to bi-weekly curbside garbage collection in 2019, the region's green bin usage went up 150% from 2017 rates![11]

The Region will continue to manage residential waste with leading edge best practices. Additional efforts are required across the community to change how commercial, industrial, and multi-unit residential buildings deal with solid waste, and to minimize the amount of GHGs that are released from landfills both inside and outside the region.

Strategy 4.2: Use less, and use it again.

While we maximize the municipal waste management system and improve commercial waste disposal, our community will need to take action to achieve a future where we not only reduce, reuse, recycle, and rot, but normalize recovering, repairing, refurbishing, and sharing.

These steps help us move away from a linear economy (take, make, dispose), and move towards a circular economy- a closed loop system where items are continuously reused. This results in lower GHG emissions largely due to the significant reduction in energy required when we use items that already exist.

10,11 Region of Waterloo. (2020) Waste Management Annual Report 2019. Retrieved from https://www.regionofwaterloo.ca/en/living-here/resources/Documents/Waste/WasteManagement_AnnualReport2019-access_Final.pdf

Take action in every part of your life, to ensure that by 2050, Waterloo Region uses less, wastes less, and no longer disposes of organic matter in landfills. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

COMMUNITY CAPACITY BUILDERS

- Organize neighbourhood tool sheds
- Host community repair workshops

BUSINESSES & ORGANIZATIONS

- Share your waste diversion rates in marketing communications, and continually look for ways to improve it
- Look for zero-waste catering options for events
- Evaluate manufacturing and other processes for ways to produce less waste, or reuse it elsewhere

INDIVIDUALS

- Talk to your landlord about the importance of implementing organics collection in your building
- When shopping for food, clothes and other household items, consider where items came from, under what circumstances they were produced, their lifecycle, and their waste footprint
- Complete a home waste audit to understand the waste you are creating, and identify zero waste solutions and alternatives

"The KW Library of Things is excited to participate in our community's Community Climate Action Strategy. When you share infrequently used items like tools, kitchen gear and garden equipment, you reduce landfill and greenhouse gas emissions. More than that, you save money, join a vibrant community and support meaningful employment opportunities. We look forward to working together for positive change!"
– Sara Wilbur-Collins, Operational Librarian
KW Library of Things (a project of Extend-A-Family Waterloo Region)

TRANSFORMATIVE CHANGE #5: BY 2050, WATERLOO REGION HAS A THRIVING LOCAL FOOD SYSTEM BUILT ON LOCAL FARMING, AND FOOD PRODUCTION AND PROCESSING THAT FEEDS MUCH OF OUR COMMUNITY.

Agricultural producers are directly impacted by a changing climate, and therefore the agricultural industry is actively planning to contribute to GHG emissions reduction efforts. Within this sector, the main sources responsible for GHG emissions are livestock, application of synthetic nitrogen fertilizers and manure, fossil fuel combustion associated with farm machinery, and the manufacturing of fertilizers and farm machinery.

While methane emissions from livestock at local farms make up 5% of our local GHG inventory (and are counted as our local agriculture sector emissions), some of the emissions from the food we eat appear in other sections of our local inventory. These show up as business use of fossil fuels for farm operations, or when vehicles are used to transport food or food waste. While we have strong local food production, much of our food is made or grown elsewhere. The emissions used to make and grow food elsewhere and transport it to the region for us to eat can be significant and are important to address. We must consider emissions from our food systems holistically, and this includes expanding our local food system here in the region, considering our impacts in other communities from foods grown elsewhere, and making efforts to eat seasonally appropriate foods.

A significant way to reduce emissions caused by the food we eat is to make more of our food close to home. A locally-based food system is also more resilient, as we are less reliant on supply chains from other parts of the world, and less vulnerable to changes or shocks in those systems.

We are fortunate in Waterloo Region to be a strong agricultural community, with land, people, and a food system that can serve as the foundation for a future where we make more of our own food.

Waterloo's diverse food processing sector includes nearly 1,400 farms and more than 130 regional food manufacturers. Our strengths include crop and animal production, snack food, confectionary, bakery, beverage manufacturing and distribution. Our community is part of the Toronto-Waterloo-Guelph Corridor, the largest food manufacturing area in Ontario and third largest in North America. Our community is just 105km from Canada's largest consumer market (Toronto), with a total of 150 million consumers within a one day drive (1200km/745mi)[12]. (WaterlooEDC).

12 *Waterloo Region Economic Development Corporation. (n.d.) Food and Beverage. Retrieved from https://www.waterlooedc.ca/en/industries/food-processing.aspx#:~:text=Waterloo's%20diverse%20food%20processing%20sector,than%20130%20regional%20food%20manufacturers.&text=This%20community%20includes%20global%20brands,Fine%20Foods%20and%20Weston%20Foods.*

KEY SUCCESS METRICS:

For our local inventory, we expect to maintain the same level of methane emissions from livestock as we did in 2010 over the next 30 years. Doing so while making more of the food we consume close to home will require reducing the emissions created by each animal, as well as consuming fewer animal products per person. This will be challenging but necessary to achieving our long-term GHG reduction target.

Results	2030	2040	2050
Maintain the same level of methane emissions from livestock as we had in 2010 tCO_2e = tonnes of carbon dioxide equivalent. It is a metric used to compare the emissions from various greenhouse gases on the basis of their global-warming potential.	213,559 tCO_2e	213,559 tCO_2e	213,559 tCO_2e

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 5.1: Protect agricultural land and the local agricultural system.

Waterloo Region has been a long-time leader in the development and implementation of land use planning protections for prime agricultural land. This protection is a continued priority for community members, those in the agricultural industry, and municipalities, and these policies must continue to be strong. Building and maintaining close relationships between our local municipalities and organizations within our local agricultural communities is critical to ensuring we meet and exceed best practices to protect our agricultural land.

Regenerative land management is a set of principles and practices that reverse current trends of degradation in soil, water and air quality by enhancing the soil ecosystem and restoring its biology. This helps mitigate climate change: reducing dependence on chemicals and pesticides resulting in more nutrient dense food, and generating greater economic viability for farmers. It also greatly assists with climate change adaptation: drawing carbon into soil and increasing resilience against drought, floods, and extreme weather events (Regeneration Canada, 2021).

"At the Food Systems Roundtable Waterloo Region, we are taking a multifunctionality approach to the climate emergency. Multifunctionality in food and farming focuses on interrelationships between agriculture production, biodiversity regeneration, and the numerous social services we derive from the land. As we are dealing with complexity, creating the conditions for the emergence of sustaining food systems requires we move beyond a check box approach for a given practice as "climate smart" and look at farming and food in this integrated way"
– Jodi Koberinski, Advisor, Food Systems Roundtable

Spotlight on Climate Justice: Indigenous knowledge and cultural practices are crucial to addressing climate change. From a food perspective, hunting, fishing, and gathering are an integral part of that knowledge and practice. While working to reduce emissions from our diets, these practices must be respected and encouraged, and we must work toward achieving food sovereignty. Food Sovereignty is "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Food Secure Canada, 2021).

Strategy 5.2: Diversify and strengthen the local agri-food sector with a focus on serving local food needs.

Supporting and continuing to build our agricultural and agri-food industry can increase the amount of food that we grow, make, and consume locally. This significantly reduces the energy needed to transport food into and out of the region. Supporting our local agricultural community directly contributes to strengthening our local economy, and increases our resilience by reducing our reliance on international supply chains.

Strategy 5.3: Support leadership in farming communities to plan and lead GHG reduction efforts, such as improving livestock production efficiency, reducing and replacing fossil fuels, and sequestering carbon.

Given our community's vision to expand local food production for local use and consumption, we do not plan for livestock emissions to decrease over the next 30 years. However, the emissions per animal, and total animals needed to fulfill our needs, must be reduced to avoid increasing our emissions from livestock. Developing methane capture strategies will contribute to this goal as our local population and therefore food production needs grow.

Strategy 5.4: Adopt low GHG emission diets.

Being aware of what is on our plate can lead to significant GHG emission reductions. Eating locally grown/produced foods reduces emissions while supporting our local economy. Community and personal gardens, as well as local foraging with an experienced guide, are great ways to become more self-reliant as well.

While eating locally is important, some foods are significantly higher in GHGs than others are. This depends on how different foods are grown/raised, processed, in addition to where they come from. Making conscious food choices in our homes, as well as having a variety of low-GHG food options including plant-based products at local restaurants and grocery stores, will contribute to our goals.

Take action in every part of your life, to ensure that by 2050, Waterloo Region has a thriving local food system built on local farming and food processing that feeds much of our community. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

COMMUNITY CAPACITY BUILDERS

- Develop resources to help local restaurants connect with local farmers
- Develop guides to help businesses and individuals choose low-GHG food options
- Make healthy low-GHG food options affordable and easily accessible

BUSINESSES & ORGANIZATIONS

- Commit to sourcing the majority of your food and beverages locally, adjusting dining options seasonally
- Only provide plant-based lunch options in meetings or at events
- Implement methods to capture methane and produce energy from manure in agricultural settings
- Utilize farming practices that sequester carbon in soils

INDIVIDUALS

- Adjust your meal planning routines seasonally, to prioritize the use of locally available products
- Reach out to your local grocery/supermarket and request they carry more locally grown/made products
- If you consume meat, participate in 'Meatless Mondays', and gradually reduce your meat consumption on a weekly and daily basis

What is your vision for Waterloo Region in 2050?

"There is a greater reliance on local farmers in the universities and communities."

-Waterloo Region community member

TRANSFORM THE WAYS WE RELATE

The ways that we relate to one another is a critical factor in how we foster relationships at all levels, and is essential to making ambitious progress towards our goals. The word ‘relate’ is rich, meaning to show or establish a connection between two or more things, or to have an understanding (of people or ideas). Our ability to relate to one another influences how we interact and communicate with, as well as learn from, those within our local community, and to others outside of that. Developing a deep understanding of how people, organizations, and communities that are different from ourselves operate and live their lives can be a powerful catalyst for action that is equitable, and raises everyone up together, especially those who have traditionally experienced disproportionality and disparity.

TRANSFORMATIVE CHANGE #6: BY 2050, WATERLOO REGION HAS LEVERAGED REDUCING GHG EMISSIONS TO INCREASE EQUITY, PROSPERITY, AND RESILIENCY FOR ALL.

The transition required to address climate change is a once-in-a-century opportunity to build the community we want. This came through strongly in our community consultation. While making the Transformative Changes, enacting the strategies, and accomplishing the action items, we must ensure that we do so in a way that makes our community more equitable, prosperous, and resilient. This will take ongoing collaboration and coordination of efforts between local sectors, community members and organizations, and with senior levels of government. There are specific strategies and activities that can support this work, identified in this section.

KEY SUCCESS METRICS:

To achieve our GHG reduction targets, we must work toward locally producing energy from carbon neutral, renewable sources. This work, as well as the other Transformative Changes, must be done in a way that increases equity and supports the members of our community that need it most. A crucial first step in doing this is establishing metrics that enable us to measure progress in reducing inequities and creating climate action solutions that increase equity. From there, we can work towards being recognized as a national leader in sustainability, clean tech, renewable energy, and energy retrofits by 2050, in a just way that benefits all.

Results	2030	2040	2050
Next steps: Establish metrics to measure progress in reducing inequities, and creating climate action solutions that increase equity	TBD	TBD	TBD
Locally produce energy from carbon neutral, renewable sources (% of local electricity consumption that is produced through local carbon neutral sources)	4%	17%	38%

STRATEGIES TO CHANGE OUR SYSTEMS:

Strategy 6.1: **Prioritize increasing equity throughout GHG reduction planning.**

Not everybody experiences the impacts of climate change in the same way or has the same means of coping with the negative consequences. Similarly, not everyone benefits from the solutions to address climate change in the same way, and in many cases, solutions that purely focus on GHG emission reductions can harm those who experience a high level of vulnerability.

As we take action on climate change, we must work to identify opportunities for reducing inequities every step of the way, prevent existing inequities from continuing further, and focus on solutions that increase equity. Building and maintaining reciprocal relationships between equity-deserving groups and local municipalities and climate action organizations is a crucial first step. Simultaneously, metrics to measure progress to ensure we achieve what we set out to must be established. To make a meaningful impact, this work must be ongoing, adequately funded, and continually evolve to reflect our community's needs. This work must be guided by the voices of those with lived experience, as we strive to meet and exceed our short and long-term targets. For this purpose, we need to ensure that our decision-making committees and leadership reflect the diversity of our community and include meaningful representation from equity-seeking groups.

Strategy 6.2: **Position Waterloo Region as a hub of clean tech, sustainability, renewable energy, and retrofits.**

Spotlight on Climate Justice: An example of the importance of considering climate justice is solar panel subsidy programs. Subsidies often benefit homeowners and those that can afford installation on private properties. But depending on how those subsidies are paid for, they can increase costs for lower-income homeowners and renters who are not able to afford installations even with subsidies. To address this, programs could be intentionally designed and implemented to support installation of solar panels and subsidies on low-income and rental housing, in a way that works for their needs and contexts. Those residents would benefit from a lowered electricity bill while GHGs are also being reduced.

Reducing GHGs is good for the economy, and a strong equitable economy is good for ensuring quality livelihoods of our community members. Transition planning, and the many mitigation projects and actions that will support it, encourage growth of the region's low carbon economy. This is through creating new jobs, tapping into our booming local technology sector, and contributing to 'building back better' in a way that leaves no one behind, as the region recovers from the impacts of the COVID-19 pandemic. By sticking to our commitments and collectively prioritizing our GHG reduction work, we can build a reputation for advancing clean economy innovation as this emerging sector continues to expand and evolve globally.

Strategy 6.3: **Ramp up local renewable energy generation.**

Local renewable energy generation has multiple benefits for our community. It provides resiliency, allowing for local sources of energy that are not dependent on global supply chains. It provides considerable investment opportunities and jobs within the community, and allows community members to be active participants in achieving our energy future.

In the longer term, we need to set up Waterloo Region to significantly scale renewable energy generation after 2030, in order to be able to produce 38% of our electricity locally by 2050.

Over the next 10 years, we need to ramp up the implementation of existing renewable energy technologies in Waterloo Region. In the short-term, this will contribute to our GHG reduction target for 2030.

Strategy 6.4: **Support GHG reduction transition planning in all organizations and households.**

To achieve our goals and ensure future prosperity, all organizations will need to transition off of fossil fuels for their buildings and transportation needs. This includes businesses, non-profit and community service organizations, and governments. Individuals and households will also need to make changes so they can move around the community and heat their homes in clean, zero emission ways.

Transitioning off of fossil fuels requires strategic planning, and everyone and every organization has an important role to play. At the same time, in order to do our parts we must be supported through this change by our local community and the structures and organizations that have the tools to make the transition realistic and attainable.

Strategy 6.5: **Coordinate advocacy to senior levels of government.**

Municipal governments currently have direct or indirect control over approximately 44% of GHG emissions in Canada , while other sources of emissions that are regulated provincially and federally make up the rest. That means that while we take the lead to address climate change in our community, the success of our efforts will also depend on policies from other levels, such as carbon pricing and the emissions from Ontario's electricity grid, and changes to provincial land use planning regulations. Achieving our 2030 and 2050 visions will require working with local organizations and governments, as well as other municipalities across Ontario and Canada, to have a coordinated voice in expressing our needs for climate action that supports equity, prosperity, and resiliency. In doing so, we should advocate for higher levels of ambition, in line with the 1.5°C degree Paris Agreement target as well as the justice and equity principles outlined in this strategy. With strength in numbers, we can provide proactive guidance to provincial and federal governments so our local action and efforts produce the intended outcomes.

13 *Federation of Canadian Municipalities. (2009, October 8). Act Locally: The Municipal Role in Fighting Climate Change. Retrieved from ttps://fcm.ca/sites/default/files/documents/resources/report/act-locally-municipal-role-fighting-climate-change.pdf*

Take action in every part of your life, to ensure that by 2050, Waterloo Region has leveraged reducing GHG emissions to increase prosperity, equity, and resiliency for all. There are endless ways you can act. Here are some examples. If you're stuck for how you can take action, refer back to The Principles for Designing a Low Carbon Future!

COMMUNITY CAPACITY BUILDERS

- Provide resources to guide businesses and organizations to ensure climate action plans focus on building equity alongside deep GHG reductions
- Provide templates for businesses and individuals to plan their renewable energy transition

BUSINESSES & ORGANIZATIONS

- Invest in doing the work to understand how your organization can work effectively with equity-seeking groups in co-creating climate actions that are equitable and accessible
- Commit to sourcing a portion of your operating energy from renewable sources

INDIVIDUALS

- Educate yourself on issues of equity, sovereignty, and accessibility, and how they relate to sustainability justice
- Participate in local climate action advocacy efforts, to aid in coordinating senior levels of government in supporting our local transition to a low carbon community

"We at 50by30WR are excited to see momentum building for bold climate action grounded in social justice as demonstrated by this report, and look forward to partnering with everyone involved in this effort to transform our region in response to the climate emergency. The moment is urgent. Waterloo region must strive to do our fair share to keep warming below a 1.5°C rise in global average temperatures worldwide to secure a safe climate future for all, as Canada committed to do in the Paris Accord, which means a minimum 50% reduction in greenhouse gases region-wide by 2030. Strong climate action implemented and scaled across multiple sectors can bring with it great and lasting benefits to a region, jumpstarting a just clean economy. 50by30WR remains committed to convening community support and engaging in the necessary advocacy to achieve the scale and speed of action required."

– Abhilasha Dewan, Andres Fuentes Martinez, Barbara Schumacher, Kai Reimer-Watts, Laura Hamilton, Megan Ruttan, Scott Morton-Ninomiya, Stephanie Goertz

PUTTING ACTIONS INTO MOTION

This strategy is meant to provide direction for all future planning by all stakeholders in Waterloo Region. While the specific strategies to move us toward each of the Transformative Changes and the actions in the 10 year plan provide helpful starting steps, the more detailed implementation of this strategy must take place through additional planning by all.

Implementation will look different between rural and urban settings, between cities and townships, between sectors, and throughout different organizations, based on the GHG emissions and makeup of their respective work and areas of influence. This might mean that implementation will happen at different speeds in different settings. The next stages include not only implementing the actions we already understand, but continually working to identify the additional actions and finer details of 'how' we go about taking climate action, within our respective spheres. The important piece is that we all continually look for opportunities to contribute to and exceed this community goal.

We must all combine this strategy with our specific expertise across our community, to build all our future work around transforming Waterloo Region into an equitable, prosperous, resilient low carbon community.

MEASUREMENT, MONITORING, AND VERIFICATION

Continuous monitoring of Waterloo region's GHG emissions across all sectors is essential to measuring progress towards achieving our community's GHG emission reduction targets.

Measuring emissions throughout an entire community is extremely difficult. There are situations where data is reliable, accurate and readily available (eg. facilities electricity data) but there is also data that is not readily available and requires creative approaches and methodologies to estimate (eg. personal vehicles).

As technology develops over the next 30 years, we will see advancements in the ease of collecting relevant data, and the increased availability of it.

Fulsome GHG inventories will be completed no less than every 5 years, with efforts to monitor progress on action items annually. To do this, the ClimateActionWR collaborative will identify indicators to aid in tracking progress against our targets and the key success metrics associated with each Transformative Change, and provide real-time data on trends as they emerge.

PART II:
TRANSFORM^{WR}
10 YEAR PLAN

OUR PATH TO 2030

TransformWR 30 Year Strategy identifies six Transformative Changes that will help us to build an equitable, prosperous, resilient low carbon community by 2050.

To get there, the next 10 years are crucial. We know from the science that change cannot wait.

To better align our work with global climate goals, we have defined an interim absolute target (total reduction) of a 30% reduction in GHG emissions by 2030. Based on population projections, this will reduce emissions 49% per person by the year 2030. Our local '30by30' target was informed by not only the GHGs we need to reduce by 2030, but by prioritizing positioning us to have laid a solid foundation for achieving our long-term target by then. Significant action will be required within the region in the coming years to achieve this interim target, but the pathway that follows is deemed both ambitious, yet achievable.

Meeting, and especially exceeding, our 2030 goal greatly depends on immediate action and supportive policies from federal and provincial governments. Key action items include:

- decarbonizing Ontario's electricity grid
- implementing carbon pricing
- enhancing provincial land use planning regulations
- increasing building code standards for energy efficiency, embodied carbon and resiliency

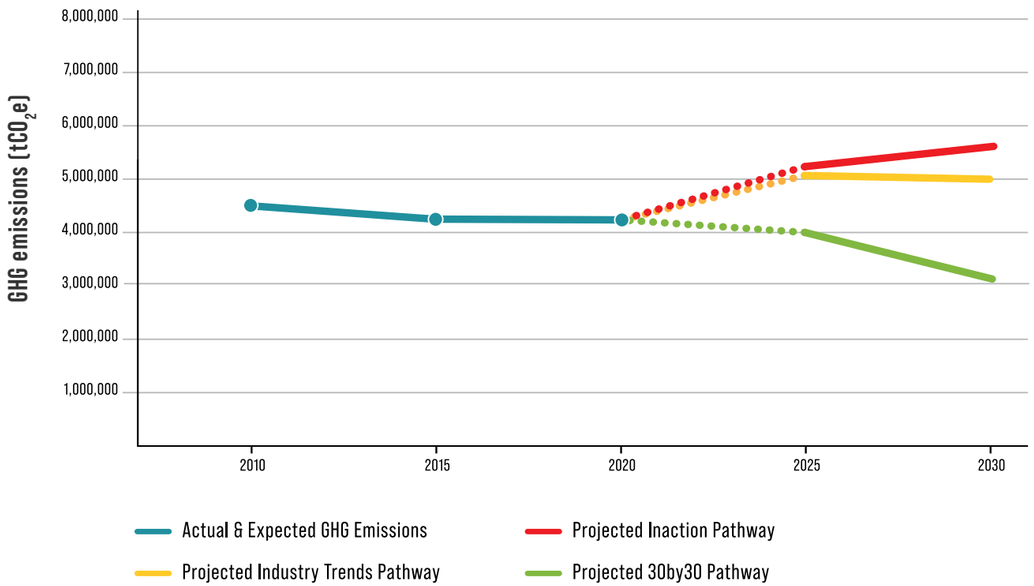


Figure 7: Waterloo Region's GHG Reduction Pathways to achieve an interim target of 30% GHG emission reduction by 2030 (based on 2010 levels).

This GHG reduction pathway is built on a model that examines three possible scenarios:

1. **Inaction:** Our population continues to grow as expected, but no further efforts are made to reduce our GHG emissions;
2. **Business as usual:** Our population continues to grow as expected, and predicted industry trends help us reduce emissions per person over time; and
3. **30by30:** Our population continues to grow as expected, industry trends help us reduce emissions per person over time, and we make further conscious changes to meet our '30by30' reduction target.

Locally, we need immediate actions to meet our goals for 2030. Those actions must be focused on two key outcomes:

- By 2030, we have reduced our GHG emissions by 30% below 2010 levels; and
- By 2030, we have laid the groundwork for transforming our community the rest of the way to achieve our target to reduce GHG emissions by 80% by the year 2050.

To meet our '30by30' target, real changes to our energy use have to start now, so that we will burn fewer fossil fuels next year, the year after, and so on.

The following action list is just the beginning. It is by no means exhaustive, and the actions differ in their scale, but it is intended to guide the next decade of climate action across our community. It is meant to serve as a starting point for more detailed planning.

Identification of these action items is step one. Implementation plans will need to be made next, and timelines will vary significantly by action. Each municipality, and indeed, each organization, household, and individual in our community will need their own climate action plans, to guide and implement their portion of this work.

While a lot of planning work is needed in the first few years, we must move quickly to implementation, so that real changes have been made by 2030.

HOW TO READ THESE ACTIONS

The 10 year plan below identifies the overarching key Transformative Changes required of our community by 2050, their associated key strategies to get there, and the specific actions that must be taken in the first decade. Many of the action items have a lead organization identified. This indicates that they are one organization committing to move this work forward, however, many of these actions will require collaboration from across the entire community, and will benefit from having multiple partners and supporting organizations involved on each one.

There are four key categories of lead organizations identified in the actions that follow. In some cases they are referred to as a whole, and in other cases, specific, named organizations or specific sectors of a category are identified.

Municipalities: There are 8 municipalities in Waterloo Region. The Region of Waterloo is the upper-tier municipality, and the 7 Area Municipalities refer to the Cities of Cambridge, Kitchener, and Waterloo, and the Townships of North Dumfries, Wellesley, Wilmot, and Woolwich.

Community Capacity Builders: Organizations that provide resources and support to other organizations or community members. This can sometimes include certain community groups and volunteer groups. Examples include Reep Green Solutions, Sustainable Waterloo Region, CycleWR, and the KW Library of Things.

Utility Companies: Organizations that maintain the infrastructure for a public service. This includes organizations such as Enbridge Gas, Energy Plus, Kitchener Utilities, Kitchener-Wilmot Hydro, and Waterloo North Hydro.

Businesses and Organizations: These include for-profit businesses, non-profit organizations, and community service organizations.

In some cases, the first step forward will be to identify the lead organization. Do you see an action that you or an organization you are associated with would like to become involved with? Let us know! Connect with the ClimateActionWR team at connect@climateactionwr.ca

SUMMARY LIST OF ACTIONS:

TRANSFORMATIVE CHANGE #1: BY 2050, MOST TRIPS ARE TAKEN USING ACTIVE TRANSPORTATION, WITH THE SUPPORT OF A ROBUST PUBLIC TRANSIT SYSTEM.

Strategy 1.1: Redesign, rebuild, and maintain our transportation system to prioritize active transportation.

Action 1.1.1: Plan a network of major active transportation corridors across cities and townships, that will provide high-volume priority travel for walking, cycling, and rolling to key destinations across the region, as well as access to public transit.

Action 1.1.2: Plan for and build neighbourhood connections to the active transportation network.

Action 1.1.3: Implement further policies across the region to prioritize active transportation in road and trail design and reconstruction.

Action 1.1.4: Identify and implement policy and program opportunities to disincentivize driving.

Action 1.1.5: Design and maintain active transportation infrastructure to ensure year-round access, safety, and comfort for people of all ages and abilities.

Strategy 1.2: Continue to build a robust and accessible public transit system that conveniently and safely serves people across the community.

Action 1.2.1: Complete Phase 2 ION to Cambridge, and plan for future higher-order transit service on additional key corridors.

Action 1.2.2: Ensure priority access for walking, cycling, and rolling to transit stations and bus stops.

Action 1.2.3: Continue to expand access to public transit across cities and townships.

Action 1.2.4: Connect people to intercity, multimodal, and emerging transportation solutions.

Action 1.2.5 Improve transit infrastructure and technologies to increase rider comfort and convenience.

Strategy 1.3: Support people to walk, cycle, or roll, and build a culture of active transportation and public transit ridership.

Action 1.3.1: Launch micro mobility systems (bike, e-bike and e-scooter-sharing systems) in Waterloo Region communities.

Action 1.3.2: Expand and innovate on existing programming (e.g. Travelwise) that supports employers and employees in making active transportation and transit the easy and preferred choice for commuting and business travel.

Action 1.3.3: Create community active transportation hubs to provide customized support, education, training, and resources.

Action 1.3.4: Develop active transportation and transit programs that target equity-deserving communities.

Action 1.3.5: Post-pandemic continued adoption of work from home and flexible work schedules for reducing trips or shifting trips to off-peak times.

Strategy 1.4: Transition to low-energy movement of commercial goods.

Action 1.4.1 Increase the efficiency of commercial goods movement.

Strategy 1.5: Build compact urban and settlement areas that are efficient for energy, services, infrastructure, and transportation, and make existing and new communities "complete communities."

Action 1.5.1: Create "15 minute neighbourhoods" where people can meet their daily needs by walking, cycling, or rolling.

Action 1.5.2: Implement design standards for new developments to build for walking, cycling, and rolling to be the primary mode of travel.

Action 1.5.3: Site key community services, health facilities, subsidized housing, etc., in central areas where they can be easily accessed using the active transportation and public transit systems.

TRANSFORMATIVE CHANGE #2: BY 2050, REMAINING PERSONAL AND COMMERCIAL VEHICLES ARE ZERO EMISSIONS VEHICLES.

Strategy 2.1: Switch personal and commercial vehicles to zero emission vehicles.

Action 2.1.1: Complete a region-wide electric vehicle strategy.

Action 2.1.2: Plan and begin to implement a transition to zero emission vehicles for municipal fleets, working towards a goal of at least half of municipal vehicles being zero-emissions by 2030.

Action 2.1.3: Plan and begin to implement the transition of commercial vehicle fleets to zero emissions vehicles.

Action 2.1.4: Grand River Transit to pilot zero emission vehicles, and implement a full zero emission vehicle strategy (full transition expected to be complete by 2040).

Action 2.1.5: Develop and implement an electric vehicle public outreach and communication strategy for personal vehicles.

Action 2.1.6: Address barriers to a transition to zero emission school buses.

Strategy 2.2: Build a network of charging/refuelling infrastructure to support the shift to zero emission vehicles.

Action 2.2.1: Provide more public electric vehicle charging stations in public spaces, commercial spaces and other places visited by the public.

Action 2.2.2: Require all new residential parking spaces, and a portion of new non-residential parking spaces, to be constructed as “EV-ready”.

Action 2.2.3: Investigate and implement local opportunities to address barriers to adding electric vehicle charging infrastructure in existing multi-residential buildings and homes.

Action 2.2.4: Investigate hydrogen vehicle trends and refuelling infrastructure options.

TRANSFORMATIVE CHANGE #3: BY 2050, WATERLOO REGION USES LESS, WASTES LESS, AND NO LONGER DISPOSES OF ORGANIC MATTER IN LANDFILLS.

Strategy 3.1: Decarbonize building heating and cooling, and water heating, by replacing furnaces and hot water heaters with highly energy efficient and low carbon equipment or fuel sources.

Action 3.1.1 Upgrade commercial and residential building walls, foundations, attics, windows and doors to reduce heat loss and air leakage.

Action 3.1.2: Implement a public literacy campaign to explain and promote the adoption of heat pumps for space and water heating in residential and commercial buildings.

Action 3.1.3 Switch home and business heating and water heating off of fossil fuels.

Action 3.1.4: Investigate and plan for full replacement of natural gas with other, non-fossil fuel sources, such as a combination of renewable natural gas and hydrogen.

Action 3.1.5: Identify and implement necessary supports to transition anyone still using fuel oil, or propane for heating to other fuel sources by 2025.

Action 3.1.6: Install renewable energy generation in business and residential buildings.

Action 3.1.7: Support households on lower income with building envelope improvements, electrifying space and water heating, and renewable energy generation.

Action 3.1.8: Identify opportunities to incentivize landlords to perform energy efficiency upgrades.

Action 3.1.9: Offer innovative loans for energy-related residential and commercial building upgrades.

Action 3.1.10: Create a one-window service to support energy-related upgrades for homes and businesses.

Action 3.1.11: Education for the development industry, architects, engineers, building inspectors, and trades on deep energy building upgrades and working with technologies such as heat pumps and solar.

Action 3.1.12: Integrate energy profiles of buildings and homes into real estate sales and leases.

Strategy 3.2: Build new buildings to be net-zero carbon, or build to transition to net-zero carbon.

Action 3.2.1: Support the adoption of highly efficient building envelope designs, hyper-efficient mechanical systems, and on-site renewable energy options for new buildings.

Action 3.2.2: Develop resources for assessing the life-cycle emissions of building materials.

Action 3.2.3: Develop region-wide building standards to encourage and support zero-carbon development of all new buildings in the region.

Action 3.2.4: Incorporate energy planning considerations into the development application review process.

Action 3.2.5: Provide training for and build capacity of building operators and property managers in operating their buildings to zero-carbon standards.

Action 3.2.6: Build capacity and expertise in the local design and construction sector to build net-zero carbon buildings.

Action 3.2.7: Show leadership by building net-zero carbon in the public sector.

TRANSFORMATIVE CHANGE #4: BY 2050, WATERLOO REGION USES LESS, WASTES LESS, AND NO LONGER DISPOSES OF ORGANIC MATTER IN LANDFILLS.

Strategy 4.1: Optimize the use of existing waste management infrastructure, including expanding diversion programs and energy capture from waste.

Action 4.1.1: Continue to maximize opportunities to expand residential curbside diversion programs, landfill gas capture and waste to energy, and reduce waste overall.

Action 4.1.2: Provide organics collection in all multi-residential buildings.

Action 4.1.3: Support the use of compost/organics collection programs for all commercial buildings.

Strategy 4.2: Use less, and use it again.

Action 4.2.1: Implement community waste reduction and circular economy campaigns.

Action 4.2.2: Build community champion programs to provide best practices and recognition for innovative commercial waste management.

Action 4.2.3: Build incentives or a local program for low to zero waste take-out options.

Action 4.2.4: Reduce unnecessary building demolitions and construction waste.

Action 4.2.5: Support programs and services that offer repair, refurbishment, and resource sharing in the community.

TRANSFORMATIVE CHANGE #5: BY 2050, WATERLOO REGION HAS A THRIVING LOCAL FOOD SYSTEM BUILT ON LOCAL FARMING AND FOOD PROCESSING THAT FEEDS MUCH OF OUR COMMUNITY.

Strategy 5.1: Protect agricultural land and the local agricultural system.

Action 5.1.1: Continue to develop and enforce robust land use planning protections for prime agricultural land.

Strategy 5.2: Diversify and strengthen the local agri-food sector with a focus on serving local food needs.

Action 5.2.1: Create a region-wide agricultural industry strategy to support the agriculture and agri-food sector.

Strategy 5.3: Support leadership in farming communities to plan and lead GHG reduction efforts, such as improving livestock production efficiency, reducing and replacing fossil fuels, and sequestering carbon.

Action 5.3.1: Support the reduction of GHG emissions from livestock, and develop methane capture and energy production from manure.

Action 5.3.2: Support ongoing efforts to reduce and replace fossil fuel use, and sequester carbon, in the agricultural industry.

Strategy 5.4: Adopt low GHG emission diets.

Action 5.4.1: Education on low GHG/sustainable eating habits.

Action: 5.4.2: Provide a variety of low GHG food options and plant-based dining options in local restaurants, grocery stores, and catered events.

TRANSFORMATIVE CHANGE #6: BY 2050, WATERLOO REGION HAS LEVERAGED REDUCING GHG EMISSIONS TO INCREASE EQUITY, PROSPERITY, AND RESILIENCY FOR ALL.

Strategy 6.1: Prioritize increasing equity throughout GHG reduction planning.

Action 6.1.1: Establish metrics to measure progress on increasing equity through GHG reduction initiatives in our community.

Action 6.1.2: Incorporate education on sustainability justice and equity into climate action planning.

Action 6.1.3: Fund a climate justice committee led by community members from equity-seeking groups.

Action 6.1.4: Provide specialized resources/support to organizations on prioritizing equity while planning their transition.

Action 6.1.5: Collaborate with Mennonite communities in the rural townships to build customized energy transition support to meet their unique needs.

Action 6.1.6: Build reciprocal relationships between Indigenous groups and local municipalities and climate action organizations to ensure GHG reduction work is done in equitable ways that respect the land and traditions of Indigenous groups.

Action 6.1.7: Increase broadband internet access.

Action 6.1.8: Apply an equity lens to all the actions in this transformation.

Strategy 6.2: Position Waterloo Region as a hub of clean tech, sustainability, renewable energy, and retrofits.

Action 6.2.1: Develop and support a clean technology cluster in Waterloo Region.

Strategy 6.3: Ramp up local renewable energy generation.

Action 6.3.1: Build the capacity for renewable energy installation.

Action 6.3.2: Implement a public literacy campaign for homeowners and property owners on renewable energy systems.

Action 6.3.3: Implement a literacy and awareness campaign for commercial scale renewable energy generation.

Action 6.3.4: Evaluate how to identify and protect optimal areas for industrial-scale renewable energy generation.

Strategy 6.4: Support GHG reduction transition planning in all organizations and households.

Action 6.4.1: Develop an energy transition plan template, and provide outreach programs and target setting support for all organizations.

Action 6.4.2: Develop an energy transition plan template, and outreach programs for all households.

Strategy 6.5: Coordinate climate advocacy to senior levels of government.

Action 6.5.1: Bring community organizations and local governments together to collectively identify and communicate advocacy priorities to multiple levels of government.

FULL DESCRIPTIONS OF ACTIONS

TRANSFORMATIVE CHANGE #1: BY 2050, MOST TRIPS ARE TAKEN USING ACTIVE TRANSPORTATION, WITH THE SUPPORT OF A ROBUST PUBLIC TRANSIT SYSTEM.

Strategy 1.1: Redesign, rebuild, and maintain our transportation system to prioritize active transportation.

Action 1.1.1: Plan a network of major active transportation corridors across cities and townships, that will provide high-volume priority travel for walking, cycling, and rolling to key destinations across the region, as well as access to public transit.

To rebuild the transportation system to prioritize active transportation, it must be planned around a region-wide network of active transportation corridors that can help large numbers of people move across the region by walking, cycling, or rolling. This network will serve as the base structure of a sustainable mobility network, and should be built for people of all ages and abilities. This work will build on the considerable efforts already underway to include all modes of travel in our transportation system. It will be led by the Region of Waterloo and the Area Municipalities.

Action 1.1.2: Plan for and build neighbourhood connections to the active transportation network.

To prepare for a time when most trips are made by walking, cycling, or rolling, neighbourhoods across the region must have comfortable, safe access to the transportation system using these modes of travel. New neighbourhoods can be designed with this access from the start, and existing neighbourhoods need to be retrofitted to ensure good access to the network. This work will be led by the Cities and Townships, in collaboration with the Region of Waterloo.

Action 1.1.3: Implement further policies across the region to prioritize active transportation in road and trail design and reconstruction.

Policies need to be in place to ensure that all renewal of infrastructure and road redesign projects are built to achieve the goal of having most trips taken by walking, cycling, or rolling, with support from transit. This work will be led by the Region of Waterloo and Area Municipalities.

Action 1.1.4: Identify and implement policy and program opportunities to disincentivize driving.

Driving and parking facilities are expensive for our community and inefficient ways of moving people, but current policies encourage driving by subsidizing roads and parking, and designing public and private spaces around car travel. Removing these incentives while improving active transportation and transit will help these efficient and low carbon alternatives become the normal and preferred means of getting to destinations. These changes must be planned to coincide with the expansion of viable low carbon transportation choices across the community, to ensure equity. This work will be led by the Region of Waterloo and Area Municipalities.

Action 1.1.5: Design and maintain active transportation infrastructure to ensure year-round access, safety, and comfort for people of all ages and abilities.

For most trips to be made by walking, cycling, or rolling, our transportation infrastructure needs to be built and maintained to be used all year, by people of all ages and abilities. This means making sure that the urban heat island effect is minimized in the hot weather, and surfaces are quickly and consistently cleared of ice and snow in the cold weather. As climate change gives us warmer, wetter, and wilder weather, this will become even more important over time. This work will be led by the Area Municipalities and the Region of Waterloo.

Strategy 1.2: Continue to build a robust and accessible public transit system that conveniently and safely serves people across the community.

Action 1.2.1: Complete Phase 2 ION to Cambridge, and plan for future higher-order transit service on additional key corridors.

ION light rail is an efficient and zero emission way of providing "higher order" transit service, where transit vehicles operate in their own dedicated lanes, making service faster and more reliable. ION efficiently moves people where transit ridership is highest, and plays a crucial role in building a reliable and frequent transit system. The second phase of ION will bring light rail transit service to Cambridge, and work on Phase 2 is currently underway. Beyond Phase 2 ION, we must advance planning for future higher-order transit service for other key corridors in the region. This work will be led by the Region of Waterloo.

Action 1.2.2: Ensure priority access for walking, cycling, and rolling to transit stations and bus stops.

For transit to support most trips being made using active transportation, we need to build seamless active transportation connections to and from transit stations and stops. This work will be led by the Region of Waterloo, in collaboration with the Area Municipalities.

Action 1.2.3: Continue to expand access to public transit across cities and townships.

More of the region's communities and residents can conveniently travel to their destinations using transit when the service is frequent, direct and available at the times it is needed. Programs to ensure everyone can afford to use transit are also crucial. This work will be led by the Region of Waterloo.

Action 1.2.4: Connect people to intercity, multimodal, and emerging transportation solutions.

The transit system must support car-free living and must therefore meet intercity travel needs and connect people to diverse and emerging energy efficient modes of travel. This includes electrified two way all day GO service to Toronto and connections to other travel modes such as active transportation, aviation, car share, buses and trains. This work includes the development of the Central Transit Station Hub, and will be led by the Region of Waterloo, Area Municipalities, and Metrolinx.

Action 1.2.5 Improve transit infrastructure and technologies to increase rider comfort and convenience.

A comfortable and convenient travel experience will encourage more residents to shift away from personal vehicle ownership and use. This includes upgrades to transit shelters, real-time trip information, etc. This work will be led by the Region of Waterloo.

Strategy 1.3: Support people to walk, cycle, or roll, and build a culture of active transportation and public transit ridership.

Action 1.3.1: Launch micro mobility systems (bike, e-bike and e-scooter-sharing systems) in Waterloo Region communities.

People must have access to the tools and resources they need to reach all parts of our communities easily and conveniently without a personal vehicle. This work will be led by the Region of Waterloo and Area Municipalities.

Action 1.3.2: Expand and innovate on existing programming (e.g. Travelwise) that support employers and employees in making active transportation and transit the easy and preferred choice for commuting and business travel.

Commuting and business travel are significant sources of our transportation emissions yet many of these trips can be made by active transportation and/or transit. Programs such as carpool matching, GRT's Corporate Transit Pass, and reimbursement for emergency rides home can help make these choices easy, normal, and low risk. This work will be led by businesses and employers, and the Region of Waterloo.

Action 1.3.3: Create community active transportation hubs to provide customized support, education, training, and resources.

While there is lots of interest in walking, rolling, and cycling, sometimes people do not know how to get started. Customized supports can help, like programs that provide DIY bike repair facilities and training, safe riding workshops, and route planning. This work will be led by the Region of Waterloo in collaboration with Area Municipalities and community capacity builders such as CycleWR.

Action 1.3.4: Develop active transportation and transit programs that target equity-deserving communities.

Not all individuals and communities have the resources to transition to low or no emission transportation. Programs to address diverse barriers must be implemented so that all residents can travel easily and safely to their destinations. These programs must be designed in partnership with equity-deserving groups, and consider interconnected barriers such as safety, funding, education, and community design. This work will be led by the Region of Waterloo and Area Municipalities.

Action 1.3.5: Post-pandemic continued adoption of work from home and flexible work schedules for reducing trips or shifting trips to off-peak times.

Working from home more often reduces our energy needs for travel by eliminating trips from work to home and back, which tend to be longer than other kinds of trips. Transportation emissions from commuting can be reduced if workplaces adopt models that include work from home and flexible work schedules. This work will be led by all businesses and employers.

Strategy 1.4: Transition to low-energy movement of commercial goods.

Action 1.4.1 Increase the efficiency of commercial goods movement.

For people to make shorter and fewer trips, we need to be able to move goods throughout the community in energy efficient ways. Route optimization, fleet right-sizing, and a shift to low energy transportation options where possible (e.g. using cargo bikes for short distances) can reduce the energy used to move commercial goods in, out of, and around our Region, and the GHG emissions that result. This work will be led by the businesses in the manufacturing and industrial sectors, with support from the Region of Waterloo and Area Municipalities.

Strategy 1.5: Build compact urban and settlement areas that are efficient for energy, services, infrastructure, and transportation, and make existing and new communities "complete communities."

Action 1.5.1: Create "15 minute neighbourhoods" where people can meet their daily needs by walking, cycling, or rolling.

Each neighbourhood can function as a vibrant and complete community, offering most, if not all, of the daily goods, services, and employment people need within walking, cycling, or rolling distance. These compact neighbourhoods help to reduce the need to travel longer distances that are impractical to make using active transportation. This work will require promoting and planning at the municipal level, and will be led by the Region of Waterloo and Area Municipalities.

Action 1.5.2: Implement design standards for new developments to build for walking, cycling, and rolling to be the primary mode of travel.

Design standards can ensure active transportation is the priority when making transportation impact assessments of new and existing developments. These standards can also address site design issues such as secure bicycle parking, pedestrian access, and vehicle parking. These standards should ensure new developments are built for people of all ages and abilities. This work will be led by Area Municipalities, with support from the Region of Waterloo.

Action 1.5.3: Site key community services, health facilities, subsidized housing, etc., in central areas where they can be easily accessed using the active transportation and public transit systems.

For people to be able to walk, cycle, or roll to meet most of their daily needs, and to rely on transit for other trips, important destinations need to be located where they are easy to access using these modes of transportation. All organizations should evaluate relocation options and future facility needs while prioritizing central access to transit and robust active transportation facilities. This work must be done by all governments, social service agencies, and community organizations.

TRANSFORMATIVE CHANGE #2: BY 2050, REMAINING PERSONAL AND COMMERCIAL VEHICLES ARE ZERO EMISSION VEHICLES.

Strategy 2.1: Switch personal and commercial vehicles to zero emission vehicles.

Action 2.1.1: Complete a region-wide electric vehicle strategy.

Market trends alone will likely translate into 20% of vehicles in the region being zero emission by 2030. Under this plan, 50% of remaining vehicles must be converted by 2030. This means our community needs to go faster and farther to electrify vehicles quickly. To support this push, a region-wide electric vehicle strategy should be created that will include partnerships, incentives, public outreach, communication and awareness strategies, and policies. The strategy is to be completed no later than 2024 and will be led by WR Community Energy, in collaboration with the electric utilities, Area Municipalities, and the Region of Waterloo.

Action 2.1.2: Plan and begin to implement a transition to zero emission vehicles for municipal fleets, working towards a goal of at least half of municipal vehicles being zero emissions by 2030.

Since businesses and households are being asked to convert at least 50% of vehicles to zero emission vehicles by 2030, municipalities can do their part by meeting or exceeding that target in their corporate fleets. Important initial steps in this work include identifying barriers to fleet transition, gathering and analyzing data on fleet performance and conversion options, and identifying funding for this work. Particular focus should be given to the vehicles that produce the most GHGs. This work will be led by the Region of Waterloo and Area Municipalities.

Action 2.1.3: Plan and begin to implement the transition of commercial vehicle fleets to zero emission vehicles.

Transitioning commercial vehicle fleets to zero emission vehicles will require planning to meet the diverse fleet needs of private companies, non-profit organizations, and governments in a low carbon future. In many cases, light duty vehicles may be easiest to convert first using electrification, but all vehicles must be transitioned off of fossil fuels by 2050. By 2030, 50% of gasoline and diesel vehicles in the region need to be zero emission, so fleet conversion must begin in the next few years. All businesses must lead this work, and opportunities to support through education programs, industry best practices, and public policies will be examined as part of creating a region-wide EV strategy (Action 2.1.1).

Action 2.1.4: Grand River Transit to pilot zero emission vehicles, and implement a full zero emission vehicle strategy (full transition expected to be complete by 2040).

Transit is a much more energy efficient and lower carbon way to make trips. Nevertheless, as transit fleets expand to provide new services, transit must also convert to zero emission vehicles. ION light rail transit is already zero emissions, running on electricity. Grand River Transit will pilot zero emission buses beginning as early as 2022, and new bus purchases are expected to be zero emissions only beginning in 2025. As diesel buses are replaced at the end of their life, the entire fleet is expected to be converted by about 2040. This work will be led by the Region of Waterloo.

Action 2.1.5: Develop and implement an electric vehicle public outreach and communication strategy for personal vehicles.

While longer term needs for public outreach and communication on electric vehicles will be evaluated during the creation of an EV strategy (Action 2.1.1), this work cannot wait for the strategy to be completed. Community members need information now that can help them make sure their next vehicle is zero emissions, and this will be key to reaching an ambitious 50% target for conversion of vehicles. An initial communications strategy for the first few years should be prepared in 2021, and implemented no later than 2022. This work will be led by ChargeWR with support from WR Community Energy, the

Region of Waterloo, Area Municipalities, and local electric utilities.

Action 2.1.6: Address barriers to a transition to zero emission school buses.

Recognizing that the provision of mass transportation for students is in itself an emissions-reduction mechanism, school buses remain key targets for a rapid transition to zero emission due to the health benefits for children from decreased air pollution and the opportunities arising from standardization and economies of scale. This is challenging to implement due to high upfront costs and the limited distance buses travel annually, as well as the required coordination between school boards, municipalities, and higher levels of government. Opportunities to address these challenges will be examined and where appropriate, advocacy to the Ministry of Education and/or the provincial government to capacitate the purchase and use of emissions free school transportation vehicles will be conducted. This work will be conducted by Student Transportation Services of Waterloo Region.

Strategy 2.2: Build a network of charging/refuelling infrastructure to support the shift to zero emission vehicles.

Action 2.2.1: Provide more public electric vehicle charging stations in public spaces, commercial spaces and other places visited by the public.

To support our community's transition to electric vehicles, our charging infrastructure must be built so that it is ready and convenient to access as people look to adopting electric vehicles. This work will be led by organizations, businesses, and governments, with support from Sustainable Waterloo Region.

Action 2.2.2: Require all new residential parking spaces, and a portion of new non-residential parking spaces, to be constructed as "EV-ready".

It is much less expensive to design new buildings to accommodate electric vehicle charging infrastructure than it is to add it afterwards. Once the right electrical conduits, capacity and outlets are in place, it is easy to add charging stations down the road as demand increases. Regulations that are part of the development review application process can require new parking spaces to be built in this way. This work will be led by Area Municipalities, in collaboration with the Region of Waterloo.

Action 2.2.3: Investigate and implement local opportunities to address barriers to adding electric vehicle charging infrastructure in existing multi-residential buildings and homes.

For existing homes, charging infrastructure will need to be added to serve all residential parking spaces, since most vehicle charging is expected to happen at home. This may be especially challenging in multi-residential buildings, where dozens or hundreds of cars may need to be charged on a nightly basis. Opportunities to address these specific challenges will be examined as part of the creation of an EV strategy, led by WR Community Energy and ChargeWR.

Action 2.2.4: Investigate hydrogen vehicle trends and refuelling infrastructure options.

Some vehicle manufacturers are building or designing zero emission vehicles that use hydrogen as a fuel. While these technologies are still under development, hydrogen is expected to provide potential solutions for key commercial vehicles that are hard to electrify. Our community must monitor this trend and make plans to ensure that access to refuelling infrastructure is not a barrier to adoption of hydrogen vehicles. This work will be led by WR Community Energy.

TRANSFORMATIVE CHANGE #3: BY 2050, BUSINESSES AND HOMES NO LONGER USE FOSSIL FUELS FOR SPACE HEATING AND COOLING, AND WATER HEATING.

Strategy 3.1: Decarbonize building heating and cooling, and water heating, by replacing furnaces and hot water heaters with highly energy efficient and low carbon equipment or fuel sources.

Action 3.1.1 Upgrade commercial and residential building walls, foundations, attics, windows and doors to reduce heat loss and air leakage.

It is easier and more economical to upgrade the heating system of a building when the building's total energy needs are reduced through air sealing and the use of added insulation and upgraded windows and doors. This work will be led by building owners with support from community capacity building organizations such as Reep Green Solutions and Sustainable Waterloo Region.

Action 3.1.2: Implement a public literacy campaign to explain and promote the adoption of electric heat pumps for space and water heating in residential and commercial buildings.

If building owners are to replace their existing heating systems with electric heat pumps or highly efficient and low carbon alternatives, they must first be aware of the need to make this switch, learn about the reliability and efficiency of heat pumps and alternatives, and plan for the switch to occur when their existing systems reach their end of life. Various communications methods should be explored to reach diverse communities across the region. This work will be led by businesses and community capacity builders such as Reep Green Solutions and Sustainable Waterloo Region.

Action 3.1.3 Switch home and business heating and water heating off of fossil fuels.

As space and water heating systems fuelled by natural gas reach their end of life, they must be replaced with highly efficient, low carbon alternatives such as electric heat pumps. By 2030, 20% of homes will be using electric heat pumps for water and space heating. By 2050, this will rise to 85% of homes. This work will be led by building owners with support from community capacity building organizations such as Reep Green Solutions and Sustainable Waterloo Region.

Action 3.1.4: Investigate and plan for full replacement of natural gas with other, non-fossil fuel sources, such as a combination of renewable natural gas and hydrogen.

While electric heat pumps are key to our transition to a low carbon community, especially in the next decade, other fuels can also play an important role, particularly for activities that are especially energy intensive. A particularly promising option that is being explored is to replace fossil fuel-based natural gas with a mix of renewable natural gas and green hydrogen. Pursuing options for transitioning existing natural gas operations to zero-carbon is crucial for achieving our 2050 target. This work will be led by Enbridge and Kitchener Utilities.

Action 3.1.5: Identify and implement necessary supports to transition anyone still using fuel oil, or propane for heating to other fuel sources by 2025.

A proportion of buildings in the region are still heated using fuel oil or propane. These are relatively expensive and carbon intensive ways to heat buildings, but there can be specific challenges building owners face in switching to other fuels. WR Community Energy will lead the investigation of these barriers locally. Implementing supports in time for transition by 2025 will require assistance from local electric and natural gas utilities, as well as municipalities.

Action 3.1.6: Install renewable energy generation in business and residential buildings.

Buildings with renewable energy generation will require less energy from the grid thereby reducing emissions associated with electricity generation. By 2030, 4% of the electricity consumed by residential and commercial buildings will be generated through solar PVs, and by 2050, that will rise to 38% of such electricity. This work will be led by building owners with support from community capacity building organizations.

Action 3.1.7: Support households on lower incomes with building envelope improvements, electrifying space and water heating, and renewable energy generation.

Not all households will have the ability and resources to transition their buildings to be low and no emission. Programs are needed to ensure lower income residents are not left behind, or left with high energy bills as a result of changes to the energy system and increasing carbon prices. This work will be led by community capacity builders such as Reep Green Solutions and utilities.

Action 3.1.8: Identify opportunities to incentivize landlords to perform energy efficiency upgrades.

Landlords may be hesitant to invest in energy efficiency upgrades when it is the tenant who enjoys the benefits of the resulting utility bill savings. Exploring ways to share the costs and benefits of upgrades or finding other ways to incentivize these upgrades will be important for reducing energy poverty and promoting health and wellbeing of tenants. This work will be led by community capacity builders such as Reep Green Solutions, WR Community Energy, and utilities.

Action 3.1.9: Offer innovative loans for energy-related residential and commercial building upgrades.

New financing options allow more building owners to undertake energy upgrades. These loans may have flexible repayment plans and may be tied to the property rather than the property owner, allowing current and future owners to share in both the resulting utility savings and the project costs. This work will be led by Area Municipalities and the Region of Waterloo with support from community capacity builders such as Reep Green Solutions and Sustainable Waterloo Region.

Action 3.1.10: Create a one-window service to support energy-related upgrades for homes and businesses.

Initiating energy-related building upgrades can be time-consuming, intimidating, and involve many technical decision points. A one-window service makes the process easier. This service may include information on all applicable incentives and best practices for energy-related upgrades, behavioural change campaigns and other supports. The service will help more building owners in performing more upgrades that reduce building-related emissions. This work will be led by WR Community Energy in collaboration with Reep Green Solutions, the Region of Waterloo, Area Municipalities, and the local utilities.

Action 3.1.11: Education for the development industry, architects, engineers, building inspectors, and trades on deep energy building upgrades and working with technologies such as heat pumps and solar.

A better informed building industry is able to plan for and provide renovations that lead to low-emission buildings. This work will be led by WR Community Energy, in collaboration with educational institutions, industry and trades organizations.

Action 3.1.12: Integrate energy profiles of buildings and homes into real estate sales and leases.

Energy profiles will allow buyers and renters to consider the operational energy costs of all buildings (both new and established) and any investments needed to upgrade the building to be carbon neutral by 2050. This will generate greater demand and value for energy-related upgrades. Outreach to realtor boards and developers will ensure they understand and support this work. As a first step, a lead organization will need to be identified for this work.

Strategy 3.2: Build new buildings to be net-zero carbon, or build to transition to net-zero carbon.

Action 3.2.1: Support the adoption of highly efficient building envelope designs, hyper-efficient mechanical systems, and on-site renewable energy options for new buildings.

The building industry must transition toward constructing new buildings to generate no net emissions during its operation. This will involve making buildings air-tight, insulated to high standards, reliant on electrified space and water heating and other highly efficient mechanical systems, and capable of generating on-site renewable energy. Ideally, a building's total annual energy use will be reduced to the point that it can be offset by the total annual output of its on-site renewable energy generation: it will be net-zero carbon. Outreach to developers and other industry professionals with information on best practices and other supports will be needed, and can be implemented quickly. This work will be led by WR Community Energy with support from Sustainable Waterloo Region.

Action 3.2.2: Develop resources for assessing the life-cycle emissions of building materials.

There are carbon emissions associated with the extraction, manufacturing, transportation, installation, use, and disposal of building materials: the embodied carbon. Tools for assessing such emissions can help builders and developers to choose materials that have low embodied carbon. It will also be important to include equity impacts as a metric in life-cycle emissions resources. This work will be led by Sustainable Waterloo Region with support from WR Community Energy, in collaboration with industry associations.

Action 3.2.3: Develop region-wide building standards to encourage and support zero-carbon development of all new buildings in the region.

Building standards can help to promote transition of local construction to building all new buildings to net-zero carbon. While local municipalities cannot directly regulate energy efficiency of buildings, energy-focused common standards across local municipalities can help to encourage buildings to be built to net-zero or net-zero ready building standards earlier, and reduce the number of buildings that need to be retrofitted later. These standards will take time to develop but will support the efforts in actions 3.2.1 and 3.2.2. This work will be led by the Area Municipalities with support from the Region of Waterloo.

Action 3.2.4: Incorporate energy planning considerations into the development application review process.

How neighbourhoods are designed can affect the energy efficiency and energy generation opportunities for decades after construction. Development review processes must incorporate our long-term energy goals. For example, buildings in neighbourhoods can be oriented to maximize rooftop solar potential, allow for community energy systems, and consider energy generation, distribution, and storage at different sites. This work will be led by the Region of Waterloo and Area Municipalities with support from local utilities and WR Community Energy.

Action 3.2.5: Provide training for and build capacity of building operators and property managers in operating their buildings to zero-carbon standards.

Even with the right design, how a building and its energy systems are used is key to how much energy the building uses. Post construction, building owners and operators are critical to the net-zero or low carbon operations of their buildings. The work includes technical management of the building as well as multilingual tenant engagement to ensure human behaviour follows the model needed for energy efficiency in the building. This work will be led by Sustainable Waterloo Region, with support from WR Community Energy.

Action 3.2.6: Build capacity and expertise in the local design and construction sector to build net-zero carbon buildings.

One of the barriers to building more sustainable buildings is the availability of expertise and trades that use the newest and best technologies. Collaborations with colleges and trades organizations will help prepare the workforce to construct the buildings of the future. This work will need to be led by educational institutions such as Conestoga College and industry associations. Public and private sector organizations can contribute to building capacity in the building sector by engaging their contractors to build net-zero carbon or net-zero carbon ready buildings, and learning the process together.

Action 3.2.7: Show leadership by building net-zero carbon in the public sector.

Public sector organizations must show leadership by having all new public sector buildings constructed to net-zero carbon. While all public sector buildings should meet this standard by no later than 2030, near-term building plans should be modified wherever possible to meet this standard, in order to decrease future retrofit costs. This work will be led by Area Municipalities, the Region of Waterloo, and other public sector land owners.

TRANSFORMATIVE CHANGE #4: BY 2050, WATERLOO REGION USES LESS, WASTES LESS, AND NO LONGER DISPOSES OF ORGANIC MATTER IN LANDFILLS.

Strategy 4.1: Optimize the use of existing waste management infrastructure, including expanding diversion programs and energy capture from waste.

Action 4.1.1: Continue to maximize opportunities to expand residential curbside diversion programs, landfill gas capture and waste to energy, and reduce waste overall.

Organic matter that is disposed of in landfills breaks down into methane, which is 25 times more damaging to our climate than carbon dioxide, so diverting organics from landfills significantly reduces emissions. As

our community transitions off of fossil fuels, local landfills may also be an increasingly important resource to generate renewable energy from landfill matter and gas. As the organization that operates the only landfill located in Waterloo Region and provides a lot of residential waste collection, the Region evaluates and implements best practices for diversion, waste reduction, gas capture, and energy generation through its waste operations. This work will be led by the Region of Waterloo.

Action 4.1.2: Provide organics collection in all multi-residential buildings.

Under provincial rules, apartments and condominiums with more than six units are responsible for their own waste collection. While the province is expected to require significant organics diversion in these buildings by 2025, multi-residential buildings face specific challenges in successfully implementing diversion programs. All residents of Waterloo Region must have access to residential organics collection. This work will be led by rental businesses and condominium corporations. Public policy options to support this transition should be explored.

Action 4.1.3: Support the use of compost/ organics collection programs for all commercial buildings.

Commercial buildings are responsible for their own waste collection. While the province is expected to require significant organics diversion in these buildings by 2025, additional educational and resource supports will help owners and occupants develop the practical solutions needed to implement organics collection. This work will be led by community capacity builders such as Sustainable Waterloo Region.

Strategy 4.2: Use less, and use it again.

Action 4.2.1: Implement community waste reduction and circular economy campaigns.

The circular economy means reusing, sharing, repairing, refurbishing, remanufacturing and recycling to create closed-loop systems for resources. This practice minimizes the use of resource inputs and the creation of waste, pollution and carbon emissions (e.g. the emissions associated with the manufacturing, transportation and breakdown of the product). Eliminating single use plastics is a particular priority, and the Zero Waste Challenge is a program that has been developed to help raise awareness of the challenge. This work will be led by community capacity builders such as Reep Green Solutions, Sustainable Waterloo Region, and Area Municipalities and the Region of Waterloo.

Action 4.2.2: Build community champion programs to provide best practices and recognition for innovative commercial waste management.

Commercial businesses need role models, support and encouragement to increase their waste diversion rates for organics and recyclables, and develop innovative ways to build the circular economy. This reduces landfill emissions from the breakdown of organics, and also reduces the emissions from the transportation of waste. This work will be led by Sustainable Waterloo Region.

Action 4.2.3: Build incentives or a local program for low to zero waste take-out options.

Since local businesses share common challenges associated with eliminating or reducing the environmental impact of take-out containers, common solutions can be found. Programs such as returnable takeout containers used at many different businesses should be explored. Some local efforts are already underway, including local reusable takeout container programs Ekko and A Friendlier Company. As a first step, a lead organization will need to be identified for this work.

Action 4.2.4: Reduce unnecessary building demolitions and construction waste.

Constructing and demolishing buildings uses significant amounts of energy and creates emissions. Manufacturing construction materials is also energy and emission-intensive. Best practices can reduce construction waste at building sites. Reusing and repurposing existing buildings and construction materials, where appropriate, can reduce the energy needed for new buildings. This work will be led by Area Municipalities and the Region of Waterloo, with support from the construction and development industries, and community capacity builders such as Architectural Conservancy Ontario.

Action 4.2.5: Support programs and services that offer repair, refurbishment, and resource sharing in the community.

These programs can lead to longer product lifespans and less waste going to landfills, while also creating jobs in the community. Because products are not replaced as often, there are fewer emissions associated with manufacturing and disposal of the products used in our community. This work will be led by community capacity builders such as the Kitchener-Waterloo Library of Things.

TRANSFORMATIVE CHANGE #5: BY 2050, WATERLOO REGION HAS A THRIVING LOCAL FOOD SYSTEM BUILT ON LOCAL FARMING AND FOOD PROCESSING THAT FEEDS MUCH OF OUR COMMUNITY.

Strategy 5.1: Protect agricultural land and the local agricultural system.

Action 5.1.1: Continue to develop and enforce robust land use planning protections for prime agricultural land.

A locally based food system relies on prime agricultural lands and the agri-food network that supports it (such as infrastructure and transportation networks; on-farm buildings and infrastructure; agricultural services, farm markets, distributors, and primary processing; and vibrant, agriculture-supportive communities). Municipalities in Waterloo Region have a strong history of providing robust protections for prime agricultural lands, and upcoming revisions to the Regional and Area Municipal official plans are expected to continue to build on that strength. This work will be led by the Area Municipalities and the Region of Waterloo.

Strategy 5.2: Diversify and strengthen the local agri-food sector with a focus on serving local food needs.

Action 5.2.1: Create a region-wide agricultural industry strategy to support the agriculture and agri-food sector.

To rely more on food grown locally, we need to protect and build an entire industry around food production, processing, and delivery.

An agricultural industry strategy can support this work while helping to build our economy. Region-wide efforts to develop a strategy to support the agri-food industry are in the early stages, and development of a formal strategy is expected to begin in 2021. This work will be led by the Region of Waterloo.

Strategy 5.3: Support leadership in farming communities to plan and lead GHG reduction efforts, such as improving livestock production efficiency, reducing and replacing fossil fuels, and sequestering carbon.

Action 5.3.1: Support the reduction of GHG emissions from livestock, and develop methane capture and energy production from manure.

When manure breaks down, it generates methane, a gas that is 25 times more damaging to our climate than carbon dioxide. When this methane is captured and burned, it reduces overall emissions and generates energy that can be used on-site. This work will be led by local agricultural organizations and the Townships, with support from WR Community Energy and local utilities regarding energy generation.

Action 5.3.2: Support ongoing efforts to reduce and replace fossil fuel use, and sequester carbon, in the agricultural industry.

Fossil fuel use can be reduced through the use of more efficient or electrified farm equipment, and through the use of renewable energy sources such as biomass, geothermal, wind and solar. Farming practices can increase the sequestration of carbon in soils while trees and shrubs in shelterbelts and woodlots can sequester carbon from the air. As a first step, a lead organization will need to be identified for this work.

Strategy 5.4: Adopt low GHG emission diets.

Action 5.4.1: Education on low GHG/ sustainable eating habits.

Information from external sources on eating low GHG diets can be both confusing and contradictory, as it varies greatly depending on where you live. Local resources must be developed in culturally sensitive ways, and made easily accessible, to guide our community in how we can choose sustainable/ low GHG eating habits. This includes plant-based diets, information on personal and community gardens, urban agriculture, and even local foraging. As a first step, a lead organization will need to be identified for this work.

Action: 5.4.2: Provide a variety of low GHG food options and plant-based dining options in local restaurants, grocery stores, and catered events.

Some foods are associated with significantly higher emissions than others. When tasty low GHG food options are more readily available for all cultural and income groups in our community, they can become a part of our everyday food choices and a part of our culture. They also reduce the environmental impact of business operations. This work will need to be done by businesses across the region, with support from organizations like Business Improvement Associations and Chambers of Commerce.

TRANSFORMATIVE CHANGE #6: BY 2050, WATERLOO REGION HAS LEVERAGED REDUCING GHG EMISSIONS TO INCREASE EQUITY, PROSPERITY, AND RESILIENCY FOR ALL.

Strategy 6.1: Prioritize increasing equity throughout GHG reduction planning.

Action 6.1.1: Establish metrics to measure progress on increasing equity through GHG reduction initiatives in our community.

Metrics must be established to measure progress in reducing inequities for the first 5-10 years of the plan. These will focus on people who are facing barriers to climate action, and identify opportunities to increase equity alongside carbon emissions reductions. This work will be led by the Region of Waterloo and Area Municipalities.

Action 6.1.2: Incorporate education on sustainability justice and equity into climate action planning.

A critical component of sustainability justice and equity is widespread education of the history of Indigenous groups, the traditional territory of the Haudenosaunee, Anishnaabe and Neutral Peoples, and systemic racism. There must be a strong understanding of the barriers that prevent the full participation of some groups in climate action, for our community to identify and eliminate them. This work will be done by all municipalities and partnering businesses, organizations, and community capacity builders.

Action 6.1.3: Fund a climate justice committee led by community members from equity-seeking groups.

Building and maintaining reciprocal relationships between equity-deserving groups, local municipalities, and climate action organizations is crucial to ensuring emission reduction planning prioritizes increased equity in our community. This is the first step in identifying additional programs and supports beyond those identified in this plan. This work will be led by the Region of Waterloo and Area Municipalities, with the support of the Viessmann Centre for Engagement and Research in Sustainability.

Action 6.1.4: Provide specialized resources/ support to organizations on prioritizing equity while planning their transition.

Many organizations are at the beginning of their equity journey, which means that equity work must scale up at the same time as transition planning scales up. To achieve a future that is equitable, prosperous, and resilient for all, organizations need support to prioritize equity as they design and implement their transition plans. This is a crucial component of broader work to build capacity, empower equity-seeking groups, build diverse leadership teams, and address ongoing inequitable practices in all organizations. This work will be led by local capacity building organizations, with support from the Area Municipalities and the Region of Waterloo.

Action 6.1.5: Collaborate with Mennonite communities in the rural townships to build customized energy transition support to meet their unique needs.

Mennonite communities in the region's rural areas have unique energy needs and will face unique challenges and opportunities as our community transitions off of fossil fuels. We must establish and maintain relationships with local Mennonite residents, and find solutions to ensure that these communities are not left behind in the transition to a low

carbon future. This work will be led by the Townships, with support from the Region of Waterloo.

Action 6.1.6: Build reciprocal relationships between Indigenous groups and local municipalities and climate action organizations to ensure GHG reduction work is done in equitable ways that respect the land and traditions of Indigenous groups.

This transformation plan is a call to action in Reconciliation efforts to build relationships between Indigenous groups and local municipalities and climate action organizations. This is critical in ensuring the voices and needs of Indigenous groups are centred in this work. This work will need to be done by all municipalities and local climate action organizations.

Action 6.1.7: Increase broadband internet access.

Reliable, fast internet access is essential to taking part in many aspects of climate action, from being enabled to work from home, accessing resources such as transit schedules, and connecting to services. Ensuring that the entire region, especially rural areas where this is not widely available today, has access to broadband connection is an important first step in empowering our community to participate in climate action, while building a more equitable community. As a first step, a lead organization will need to be identified for this work.

Action 6.1.8: Apply an equity lens to all the actions in this transformation.

It is only by integrating equity considerations into all of our actions and decisions that we can transform our community into a low carbon society that enriches all of its members. This includes actively working toward climate justice, anti-racism, and decolonization. This work will be done by all municipalities and partnering businesses, organizations, and community capacity builders.

Strategy 6.2: Position Waterloo Region as a hub of clean tech, sustainability, renewable energy, and retrofits.

Action 6.2.1: Develop and support a clean technology cluster in Waterloo Region.

The global clean economy sector will continue to grow in coming decades to support the transition off fossil fuels. We can help our community to thrive in this new economy by marketing Waterloo Region as a place to advance clean economy innovation. This will help us attract businesses, industries, investments, and expertise that will help to advance the clean economy both here and around the world. The first stage of work, to produce a cluster map, is underway through a partnership between the Region of Waterloo, Sustainable Waterloo Region, Waterloo EDC, and WR Community Energy.

Strategy 6.3: Ramp up local renewable energy generation.

Action 6.3.1: Build the capacity for renewable energy installation.

Contractors must be engaged and trained in the installation of local renewable energy generation if this industry is to ramp up to meet our goals. By 2050, 38% of our local electricity will be generated through local renewable energy generation. This work will involve training institutions, industry associations, and investors.

Action 6.3.2: Implement a public literacy campaign for homeowners and property owners on renewable energy systems.

Introduce homeowners and property owners to the generation potential, benefits, financing opportunities, policies, technologies, and other dimensions for the next wave of solar rooftop and other small on-site renewable energy systems. This work will be led by community capacity builders such as Reep Green Solutions with support from local utilities.

Action 6.3.3: Implement a literacy and awareness campaign for commercial scale renewable energy generation.

Introduce commercial property owners to the generation potential, benefits, financing structures, policies, technologies, international examples and other dimensions for the next wave of commercial scale renewable/local energy systems. As a first step, a lead organization will need to be identified for this work and should include collaboration with local utilities.

Action 6.3.4: Evaluate how to identify and protect optimal areas for industrial-scale renewable energy generation.

Suitable sites for large, industrial-scale renewable energy production in the region must be identified and planned for, to ensure that those sites are both available and accessible to meet future local energy production needs. This work will be led by the Region of Waterloo, in consultation with the Area Municipalities and local utilities.

Strategy 6.4: Support GHG reduction transition planning in all organizations and households.

Action 6.4.1: Develop an energy transition plan template, and provide outreach programs and target setting support for all organizations.

All organizations will need to adopt sustainability practices and transition off of fossil fuel use in their buildings and fleet owned vehicles. This transition will require awareness of the goals, and strategic planning supports. This work will be led by Sustainable Waterloo Region.

Action 6.4.2: Develop an energy transition plan template and outreach programs for all households.

All households will also need to adopt sustainability practices and transition off of fossil fuel use in their homes and vehicles. A template emission reduction plan can help each household plan their own energy transition in a way that supports the climate goals of their community. This work will be led by Reep Green Solutions.

Strategy 6.5: Coordinate climate advocacy to senior levels of government.

Action 6.5.1: Bring community organizations and local government together to collectively identify and communicate advocacy priorities to multiple levels of governments.

Our local climate goals cannot be achieved without supportive policies and regulations from provincial and federal governments. By reaching consensus on the key issues, local organizations and municipalities can more effectively advocate for climate change policies that support our local climate goals. These key issues are to be identified by 2022. This work will be led by the Region of Waterloo and Area Municipalities.

LOOKING AHEAD

TransformWR leverages community input, technical advice, and collaboration with municipal partners to guide the Region's 30-year transition to a low carbon future.

The context within which this transition must take place is complex and the changes required will be transformational. With that being said, a strong sense of hope emerges out of this vision and strategy.

A promise of a flourishing community that sees economic and social prosperity as fundamentally connected to ecological health. A rallying call to leverage our strengths, collaborate, and overcome adversity, together. A global challenge with local causes and local solutions.

This strategy is designed to be resilient to the challenges and opportunities that exist over the next 30 years—some we can predict and others we can't. It's a framework, rather than an exact to-do list. It contains a clear direction but isn't so rigid that it breaks down under the weight of time and uncertainty.

Everybody belongs in the future we are envisioning together, and thus, there is room for everyone in these pages. There has to be. It will take significant effort and community collaboration to realize the goals outlined within them. ClimateActionWR will continue to convene partners around these strategic directions and build momentum towards change.

For our community and for generations to come.

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“Because the future and well-being of our youth, our planet and all the diverse species who inhabit it is worth more than profits and power.”

Beth, 23 years old

APPENDICES

APPENDIX A: COMPANION DOCUMENTS

The following documents are available as companion documents. They either provide supporting information on how the strategy was developed, or are resources as part of a growing toolkit that expands on some of the key points addressed within.

All of these documents can be found on the climateactionwr.ca website.

Supporting Documents

Community Engagement Report. A summary of the community engagement efforts associated with the development of this strategy, led by Unless Design Partners.

Technical Engagement Report. A summary of the technical engagement efforts associated with the development of this strategy, led by WalterFedy.

Technical Report. The full report developed by WalterFedy, that was used to develop the technical pathway to achieving our 80% GHG emission reduction targets by 2050.

Toolkit Resources

Sustainability Justice Guide. A guide to help organizations surface considerations of equity, sovereignty, and accessibility early in project planning and decision making processes.

Decision Making Framework. The integration of a climate lens in decision making begins with our municipal processes. This resource provides a simplified guide for understanding the channels for community level decision making, and how other organizations and individuals can support municipal decision makers.

APPENDIX B: COMMENTARY ON A ROADMAP TO CARBON NEUTRAL BY 2050

Since our ‘80by50’ target was first endorsed, we recognize there has been significant community momentum towards carbon neutrality (a 100% GHG reduction by 2050) and local interest from community groups in setting an interim target of 50% GHG reduction by 2030 (based on 2010 levels).

Waterloo Region’s 80% GHG reduction target was set and endorsed by our local municipalities in 2018. At that time, this ambitious target was in line with both the provincial and federal reduction targets, as well as several other municipalities across Canada. While this long-term strategy is focused on achieving an 80% reduction, we position the 80% as the minimum we need to achieve. We understand the urgency for ambitious climate action and our strategy is reflective of that, along with what we have heard is realistic from our local experts and community members.

Note: The Province of Ontario uses 2005 for their baseline year, while Waterloo Region uses 2010 based on when local emissions data became available after the completion of our first community inventory. Provincial emissions in 2010 were very similar to what they were in 2005, and therefore our baseline years are comparable.

A secondary analysis was developed to demonstrate the additional requirements needed to achieve a goal of 100% reduction by 2050, with a more significant interim goal of 50% GHG reduction by 2030. The following charts show the 11 largest impact changes necessary to achieving these alternate pathways, and compares our current targets (in blue) to the more ambitious proposed targets (in green).

Residential Actions	By 2030: 30%	By 2030: 50%	By 2050: 80%	By 2050: 100%
Homes using electric heat pumps, or equipment that is at least as energy efficient and low carbon as electric heat pumps, instead of natural gas (% of residential buildings with electric heat pumps, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric heat pump)	20%	60%	85%	100%
Homes using energy efficient and low carbon water heaters instead of natural gas (% of residential buildings with electric water heaters, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric water heater)	20%	60%	85%	100%
Locally produce energy from carbon neutral, renewable sources (% of local electricity consumption that is produced through local carbon neutral sources)	4%	20%	38%	250%*

Business Actions	By 2030: 30%	By 2030: 50%	By 2050: 80%	By 2050: 100%
Make ICI processes more energy efficient (% of energy reduced)	10%	10%	30%	60%
Buildings using electric heat pumps, or equipment that is at least as energy efficient and low carbon as electric heat pumps, instead of natural gas (% of buildings with heat pumps, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric heat pump)	20%	60%	85%	100%

Business Actions	By 2030: 30%	By 2030: 50%	By 2050: 80%	By 2050: 100%
Buildings using energy efficient and low carbon water heaters instead of natural gas (% of buildings with electric water heaters, or equipment with a minimum COP of 3 that produces no more GHG emissions than an equivalent electric water heater)	20%	60%	85%	100%
Locally produce energy from carbon neutral, renewable sources (% of local electricity consumption that is produced through local carbon neutral sources)	4%	20%	38%	250%*

Transportation Actions	By 2030: 30%	By 2030: 50%	By 2050: 80%	By 2050: 100%
Reduction in trip length (% reduction in vehicle distance travelled, for trips over 5km)	2%	20%	10%	10%
Replacing personal vehicle use for trips under 5km by using active transportation (% of existing short vehicle trips switched to walking, cycling, or rolling)	10%	70%	80%	100%
Reduction in travel due to work from home options (% reduction in vehicle trips to workplaces)	10%	40%	40%	50%
Reduction in discretionary trips (% reduction in vehicle distance travelled for discretionary trips)	4%	10%	18%	18%
Increase efficiency of delivery routes (% reduction in fuel consumption for trips over 5km)	4%	10%	18%	50%

**Note that the '100by50' pathway requires the use of carbon offsets.*

To enable the key changes identified in the table, additional supports would be required:

- Provincial changes must be made to the electricity grid, to ensure our electricity comes from as low GHG emitting sources as possible (and remains that way); and
- Carbon offsets will need to be used as a mechanism to achieve carbon neutrality by 2050.

Our analysis while developing this strategy shows the recommended '30by30' target is very ambitious, especially in consideration of the planning time required to put actions into motion before the results of such changes are evident. With that said, throughout implementation of the '80by50' climate action strategy, we will keep these additional targets front of mind, and take every opportunity we can to encourage more ambitious climate action where opportunities arise, to achieve our 80% reduction target earlier, and set us on a path to exceed it.

Carbon offsets are a reduction in carbon dioxide or other GHG emissions made in order to compensate for emissions made elsewhere. They are sold to enable the purchaser to claim the GHG reductions as their own.

APPENDIX C: SUMMARY OF ENGAGEMENT

In order to create both long and short-term approaches to GHG reductions, it was crucial to gain the perspectives and tap the wisdom of a wide group of people through thorough engagement of a wide range of stakeholders across our community as well as beyond. Engagement for this project was split into two sections: Community Engagement and Technical Engagement. With collaborative efforts on this project extended to the local expertise involved in its development, each section was led by a local consultant with expertise engaging related stakeholders.

The summary reports on community and technical engagement from the consultants who led those initiatives, can be found on the climateactionwr.ca website (see Appendix A: 'Companion Documents')

C.1 COMMUNITY ACTIONS

Community engagement and brainstorming was an important element of understanding what our community's vision of 2050 is, and what it wants from a climate action strategy. Between June 2019 and January 2020, ClimateActionWR connected with over 1600 community members to hear and discuss their insights on the future of Waterloo Region. In addition to the insights provided in the full Community Engagement Summary prepared by Unless Design Partners (See Appendix B), the following shares the outputs and action items that resulted specifically from 'Street Team' efforts, and our community workshop series.

With the support of 'Street Team volunteers', ClimateActionWR attended 35 local events to ask the community "What should be in place in Waterloo Region to make it possible for you to reduce your (GHG) emissions at work, home, and in transportation?"

Figure 8: The most common words in all 1400 action ideas with size corresponding to the frequency, most frequent being the largest.

Over 900 community members participated and provided ideas and insights. Over the course of 5 community workshops, 83 community members participated in a long-term visioning exercise, imagining the state of the region 10, 20 and 30 years into the future while recording the actions that would take place to help reach the end goals.

With the workshop encouraging our community to imagine what potential changes we can see in the coming decades, we noted trends envisioning: innovation with vertical farms, growth with a circular economy, increased efficiency of waste handling and sorting, changes in mindsets and food choices for more sustainable options, and a general bump in the sense of community support and sharing needed to achieve our goals.

Over 1400 individual action ideas were collected from these engagement and outreach activities. Trends emerged where the community hopes to receive support in making sustainable

changes and choices in their lives. Areas where government support was proposed include electric vehicle subsidies, incentives for renewable energy, water conservation, and universal basic income pilot projects.

There was support for additional regulations at local, national and international levels with plastic bans, increased carbon taxes, restrictions on multiple car and home ownership, and laws against idling. Community members recognize that some climate action changes can be done on an individual scale by making sustainable choices but others require aid from regulatory agents.

Residentially, net-zero solutions and increasing density were the most common themes. Many community members envision a future in our region with more co-operative housing, co-mortgages available, and multi-generational housing or home-sharing becoming the norm. Their hopes are that we will see existing homes receive incentives to aid with retrofitting and implementing renewable energy generation tools, and new homes will be designed with sustainability and functionality in mind, and an increase of community food gardens.

Within the ICI sector, packaging, office spaces, employee behaviours, were all larger areas of concern/idea generation. For companies that produce products that require packaging, programs that offer ways to recycle the packaging were recommended, the elimination of plastic packaging was also suggested, and having things be sold for their "true cost", which would include embodied carbon. Before the COVID pandemic made it necessary, the community was already wanting to see an increase of work from home policies and flexibility with working hours. In offices, a transition to paperless practices, practices that encourage turning off lights and electronic devices when not in use, elimination of plastics, and introduction of composting to office kitchens, were all mentioned repeatedly.

Waterloo Region community members seem keen to make changes with their transportation habits and infrastructure based on the volume and range of related action items. Of all transportation action items received, 27% were related to public transit and 16% were related to electric vehicles. The recurring actions within the transportation sector were more affordable public transit, extended public transit infrastructure across the region and the province, increased costs associated with personal vehicle ownership including parking and fuel, and innovation with electric vehicle batteries.

Waterloo Region is socially and geographically diverse, and there were notable differences of insights gathered between the rural and urban areas. The most common areas of action identified from residents of our four local townships were increased public transportation options between the townships and cities, additional bike lanes, alternative energy generation, more affordable electric vehicles and charging stations, reduction of single-use plastic, and waste programs for local events & businesses. Changes within downtown core areas were also commonly identified, with community members envisioning areas where personal vehicles are banned, separated bike lanes, expanded light rail transit to include the rural areas, infrastructure that supports pedestrians and small businesses, complete streets, and food forests are all featured.

APPENDIX D: COMMUNITY CARBON BUDGET FOR WATERLOO REGION

This strategy looks at emissions reductions in terms of meeting annual future targets, which has been a common way of planning GHG reductions. A carbon budget is another, complementary way of planning GHG reductions. It is based on determining how much of the world's remaining carbon emissions a community is entitled to use.

There are a few key features of carbon budgets:

Carbon budgets are based on science. Because greenhouse gases released into the atmosphere remain for decades or centuries, there is a limited amount of greenhouse gases that can be released into the atmosphere while limiting warming to a 1.5°C increase in average global temperatures. A carbon budget splits up the remaining carbon that can be released on a per capita basis, and allocates it to communities or organizations to use as they work to end their emission of GHGs.

Carbon budgets recognize that carbon is a finite resource. Like a financial budget, a carbon budget recognizes that, once some carbon has been spent, less is available for future spending. There is a limited amount of carbon humans can continue to emit while limiting the worst impacts of climate change. In this way, carbon is like money, except without the opportunity to refill the bank account.

Carbon budgets are about equity. They are intended to ensure that rich countries like Canada do not continue to use most of the world's carbon for their own activities, and leave less affluent countries with fewer energy resources to complete their own transitions off of fossil fuels.

Carbon budgets make it clear that emissions reductions made earlier are better than emissions reductions made later. Since what matters is the total amount of carbon spent in the coming decades, carbon budgets favour early action. Making changes early means that the resulting emissions reductions often continue over subsequent years. Making the same changes later will make less of a difference to the overall emissions produced.

Municipal councils in Waterloo Region, as part of declaring a climate emergency or crisis, have expressed interest in approaches using carbon budgets. As part of the '80by50' project, community and municipal stakeholders asked for WalterFedy to also calculate the community's carbon budget. This will provide a common starting point for any future tools or approaches that are developed locally for specific organizations that are based on this carbon budgeting approach.

The total carbon budget for Waterloo Region is calculated to be 66.84 megatonnes of CO_2e, or 66,840,000 tonnes of CO_2e.

CALCULATING WATERLOO REGION'S CARBON BUDGET

C40 Cities has developed a carbon budget for some of the largest cities in the world. Other cities, such as Edmonton, are using this approach to determine their own carbon budgets to identify how much of the world's remaining carbon their residents are entitled to. For their assessment, WalterFedy used the methodology used by the C-40 cities and the City of Edmonton.

The carbon budget for Waterloo Region is based on the following key data points:

- The per capita GHG emissions in 2016, which for 2016 was estimated to be 7.04 tonnes per person
- The per capita GHG emissions that are needed in 2050, which is zero
- The per capita GHG emissions that are needed in 2030, which is set by the C-40 cities at 3.1 tonnes per person

Then a curve is created using a function, to produce a graph that looks like this:

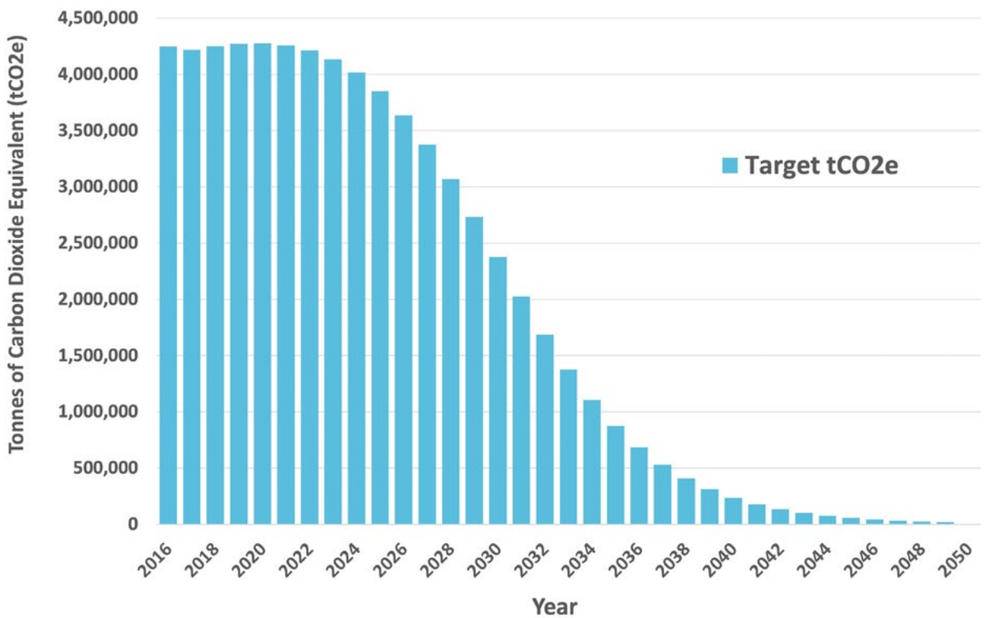

Figure 9: Waterloo Region's carbon budget curve with tonnes of carbon dioxide equivalent by year to stay within our carbon budget.

Once the GHGs per year are identified using this calculation, all the years' emissions are added together. This produces one number that represents the total amount of carbon the community is entitled to spend over the next several decades, before reaching net-zero emissions.

	Target tCO_2e	Population	Target tCO_2e/person
2015	–	593,854	7.2
2016	4,249,375	603,824	7.0
2017	4,218,607	613,795	6.9
2018	4,251,846	623,766	6.8
2019	4,272,339	633,737	6.7
2020	4,276,125	643,707	6.6
2021	4,258,339	653,678	6.5
2022	4,213,248	663,649	6.4
2023	4,134,491	673,620	6.1
2024	4,015,630	683,590	5.9
2025	3,851,110	693,561	5.6
2026	3,637,602	703,532	5.2
2027	3,375,544	713,502	4.7
2028	3,070,387	723,473	4.2
2029	2,732,953	733,444	3.7
2030	2,378,422	743,415	3.2
2031	2,024,008	753,385	2.7
2032	1,686,026	763,356	2.2
2033	1,377,352	773,327	1.8
2034	1,106,048	783,298	1.4
2035	875,314	793,268	1.1
2036	684,402	803,239	0.85
2037	529,934	813,210	0.65
2038	407,167	823,180	0.49
2039	310,953	833,151	0.37
2040	236,364	843,122	0.28
2041	179,021	853,093	0.21
2042	135,217	863,063	0.16
2043	101,916	873,034	0.12
2044	76,693	883,005	0.09
2045	57,642	892,976	0.06
2046	43,282	902,946	0.05
2047	32,475	912,917	0.04
2048	24,353	922,888	0.03
2049	18,254	932,859	0.02
2050	0	942,829	0
CUMULATIVE TOTAL	**66,842,437 tCO_2e 66.8 $MtCO_2e$**		

Using this approach, the total carbon budget for human GHG emissions made within Waterloo Region is 66.84 $MtCO_2e$. This 66.84 megatonnes is the amount of the world's remaining carbon to which our community is entitled.

Once the final number is identified, the annual numbers are much less important. While the specific annual numbers in the graph above can give a sense of whether the community is on track to stay within its carbon budget, carbon expenditures in a given year do not have to align with the graph, necessarily. The idea behind a carbon budget is to use that total budget number to create a plan to transition off of fossil fuels that stays within that carbon budget. This could involve "spending" more carbon up front and then reducing emissions more quickly after, or it could involve a more consistent reduction in the amount of carbon spent over time. What matters is staying within the overall carbon budget.

PLANNING FOR WATERLOO REGION'S CARBON EXPENDITURES

This total carbon budget number is an important tool. Knowing how much carbon we are entitled to spend helps us to evaluate different approaches to reducing and eliminating emissions in the coming decades. In planning for the community, our long-term goal is to reduce and eventually eliminate GHG emissions from human activities.

At the same time, our local strategy moving forward must be based on ambitious but achievable actions that can be taken to reduce emissions. This approach is outlined in the full strategy document.

We are able to assess our emissions reduction plans in comparison to this carbon budget number, by calculating the expected total emissions from the '80by50' pathway. The '80by50' pathway produces an expected 96.51 megatonnes CO_2e. While the more aggressive timelines assessed in Appendix A get closer to Waterloo Region's carbon budget (at 77.11 megatonnes CO_2e), none of the potential pathways explored for this project is currently expected to keep the community's carbon expenditures within our calculated carbon budget.

To stay within our carbon budget, significant changes will be needed outside of our local control. In particular, the model used to develop our recommended pathway uses projections of GHG emissions from our electricity grid currently used by the Independent Electricity System Operator for Ontario. They presume that we will meet our increasing electricity needs using natural gas plants, and thus our emissions from electricity are expected to rise significantly over the timeframe of this strategy. Staying within our carbon budget will require a zero emission electricity grid. It will also likely require the use of additional carbon offsets, which are not included in our recommended '80by50' pathway.

What this means for action in our community is clear. Over the next three decades, we need to achieve everything outlined in this strategy, and more. The path forward, guided by this strategy, will put Waterloo Region in the best possible position to make future, further gains in emissions reductions as our technology, our society, and our community continue to change over the next 30 years.

"Our future is at stake, it has now become our job to ensure we don't exceed the climate tipping point, where change is too late. Now we must take action and prevent this problem from getting worse, ... we have the power in our hands, right now to make sure this doesn't happen. Together as a community we can make a difference and we can make change happen."

Kayley, 14 years old

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