# Appendix B: Scenario Analyses Report

# Genesee - Finger Lakes Scenario Analyses

**Draft**

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# Project summary

T The purpose of the climate action plan project is to help guide the development and implementation of projects across the Genesee-Finger Lakes Region that have the most significant potential to decrease greenhouse gas emissions, while also improving the vibrancy, equity, resiliency and health of the region as well. The final output of this project will be an emissions reduction target for the region and a set of corresponding measures and actions to achieve this goal, all documented in a **Climate Action Strategy for the Genesee-**



*Figure 1: Map of the Genesee-Finger Lakes Region (Source: www.gflrpc.org)*

**Finger Lakes Region**. This Plan seeks to align with the state-wide emissions targets set forth in the historic Climate Leadership and Community Protection Act (CLCPA)[1] and also takes into account the wide-ranging technological improvements since the Finger Lakes Sustainability Plan from 2013[2].

These are the project objectives:

1. To develop a database of emissions and existing climate change-related plans and policies in the Genesee-Finger Lakes Region,
2. To foster dialogue amongst regional stakeholders from different sectors, government entities and community groups to determine what kind of mitigation strategies are plausible and desirable for the Finger Lakes Region,
3. To analyze potential GHG emission reduction measures and social and economic implications of those measures, with particular emphasis on equity, inclusion and climate resiliency,
4. To develop a range of scenarios to guide a climate action strategy,
5. To set an emissions target for the region and prioritize measures that are environmentally, socially, technically, and economically feasible,
6. To identify implementation actors, requirements, timing, and constraints,
7. To develop a plan to monitor progress towards the emissions target, and

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[1] Environmental Conservation Law (ECL) Article 75 and as adopted in 6 NYCRR Part 496 (https://www.dec.ny.gov/docs/administration_pdf/revrissum496.pdf)

[2] 2013 Finger Lakes Sustainability Plan: http://www.gflrpc.org/sustainabilityplan.html

8. To strengthen the capacity of local and regional stakeholders to carry out updates to the climate action strategy in the future.

The following project is led by the **Climate Solutions Accelerator (CSA)** in partnership with the **Stockholm Environment Institute's (SEI's) U.S. Center**. The proposed approach consists of four phases: scoping, baseline assessment, scenario analysis, and action plan development, with stakeholder engagement with implementation agencies, sectors, and marginalized groups playing a key role in the process. A summary of the 4-phase project approach is shown in the following figure:
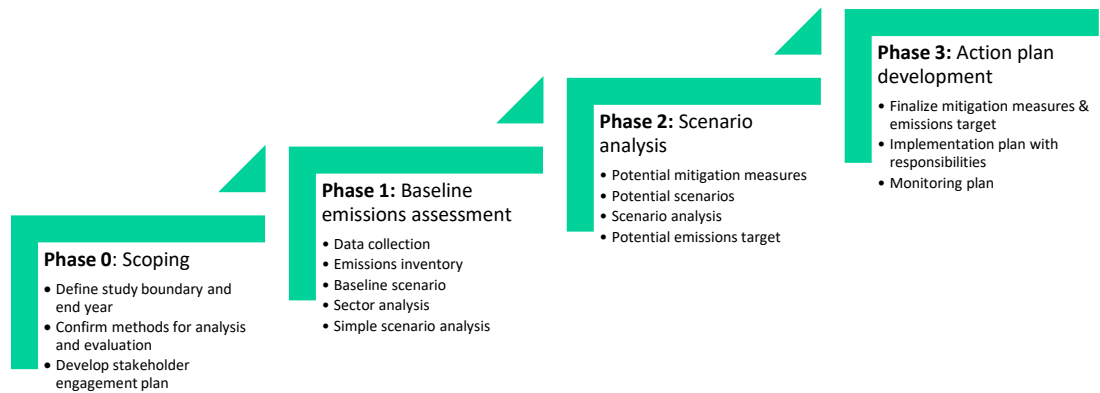


**Phase 0**: Scoping
• Define study boundary and end year
• Confirm methods for analysis and evaluation
• Develop stakeholder engagement plan

**Phase 1:** Baseline emissions assessment
• Data collection
• Emissions inventory
• Baseline scenario
• Sector analysis
• Simple scenario analysis

**Phase 2:** Scenario analysis
• Potential mitigation measures
• Potential scenarios
• Scenario analysis
• Potential emissions target

**Phase 3:** Action plan development
• Finalize mitigation measures & emissions target
• Implementation plan with responsibilities
• Monitoring plan

*Figure 2: Phases of the Genesee-Finger Lakes Climate Action Strategy*

The following report provides the results from Phase 2: Scenario analysis.

# 1 Scenario analysis methodology

The scenario analysis builds on the emissions inventory and baseline emissions projections developed during Phase 1. The scenario analysis assesses the long-term emissions reduction potential for the Genesee-Finger Lakes region under alternate climate mitigation pathways. To achieve this goal, the scenario analysis has the following objectives:

• Consult a wide range of stakeholders across different demographic segments, communities and economic sectors on their long-term vision for the region
• Compile stakeholder responses to identify common themes and emerging emission reduction measures of priority for the region
• Review relevant municipal, regional, state-level and federal climate action policies and plans for emission reduction measures relevant to this study
• Develop multiple scenarios each with their own set of emission reduction measures representing varying degrees of emissions reduction potential
• Calculate the emissions reduction potential under each scenario
• Review scenario results and measures with key stakeholders for feedback

- Establish a set of long-term emission reduction measures for the region, and an associated regional emissions target
- Provide a starting point for discussion on potential short-term actions needed to achieve the emissions reduction target for the region

This report documents each step of the scenario analysis, including the methodology and data sources used to assess county-level emission reductions by major economic sector and source. Assumptions are used where data is scarce and are noted in this report.

Similar to the emissions inventory exercise, this is meant to be an initial assessment of potential emission reduction measures from large sources of emissions and large emitters. This exercise will not be a one-time activity. We hope to establish a process for continually updating the emissions inventory and scenario analysis as more data and suggestions are made by stakeholders, institutions, facilities or organizations, as new technologies come into play, and to track emissions reductions over time.

The data from the emissions inventory and scenario analysis are currently being stored in the Low Emissions Analysis Platform (LEAP)[3] with plans to create a publicly available tool to view the county-level emissions inventory and potential emissions reduction under different scenarios. LEAP provides the structure for organizing data, calculations and results for an emissions inventory and scenario analysis. All data, equations and assumptions used in LEAP are presented in this report.

# 2 Highlights of stakeholder engagement activities

To ensure a climate action strategy that is supported by the community, a series of stakeholder engagement activities were conducted throughout 2021, including a survey, place-based and sector-based focus groups, and a workshop. These activities were led by the Climate Solutions Accelerator, with technical support and guidance from SEI as needed. A brief overview of each activity and how the input informed the scenario analysis is provided in this section.

## 2.1 Online Survey (April 2021)

As a first step for community engagement, an online survey of 18 questions was sent out to residents throughout the nine counties in the Genesee-Finger Lakes region in April 2021. The aim of the survey was to gain an understanding of the level of climate awareness by residents in the region, the challenges faced by community members in incorporating sustainability measures into their lifestyles and businesses, and the most favorable climate solutions. The

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[3] http://leap.sei.org/

survey was distributed through online newsletters, social media channels and a webinar. The survey was anonymous and had questions on the respondent's gender, race, income bracket and education level. The survey questions are provided in **Appendix A**. In total, 648 responses were recorded, however only 450 respondents fully completed the survey.

The survey results had broad coverage across gender and income. Among the respondents that indicated their race, the majority identified as 'White or Caucasian' (83%). Most respondents had a Bachelor or Advanced degree. The coverage across each county roughly aligns with the population share between each county. A small percentage of respondents said they were located outside the region. Further details on the survey respondents are provided in Table 1.

*Table 1: Only survey respondent demographics*

| Gender (n=429) | Income (n=405) | Education (n=429) |
|---|---|---|
| • Woman (54%)<br>• Man (39%)<br>• Non-Binary (2%)<br>• Prefer not to answer (4%)<br>• Prefer to self-identify (1%) | • <$25K (5%)<br>• $25-$50K (20%)<br>• $50-$75K (16%)<br>• $75-$100K (23%)<br>• $100-$125K (15%)<br>• >$125K (21%) | • Grade school (1%)<br>• High School (6%)<br>• Associates or trade degree (8%)<br>• Bachelor's degree (36%)<br>• Advanced degree (48%) |

| Race (n=429) | County (n=423) | |
|---|---|---|
| • White or Caucasian (83%)<br>• Hispanic or Latino (5%)<br>• Other (4%)<br>• Multiracial/Biracial (3%)<br>• Black/African American (2%)<br>• Asian or Pacific Islander (2%)<br>• Native American or Alaskan Native (0.2%) | • Monroe (65%)<br>• Genesee (13%)<br>• Ontario (10%)<br>• Livingston (2%)<br>• Orleans (2%) | • Seneca (2%)<br>• Wayne (1%)<br>• Yates (0.7%)<br>• Wyoming (0.2%)<br>• Other (4%) |

As shown in Figure 3, most respondents were somewhat or very knowledgeable about climate change and climate solutions. Over 73% of respondents were very willing to adopt climate solutions and 25% were somewhat willing. Only 3% of respondents were not at all willing to adopt climate solutions. The high-level findings from the survey are summarised in Table 2 below. Excel's 'Data Analysis' feature was used to identify priorities where possible. For more subjective answers, we performed a search for key phrases to capture the top 3 ideas/concepts emerging from respondent's answers.
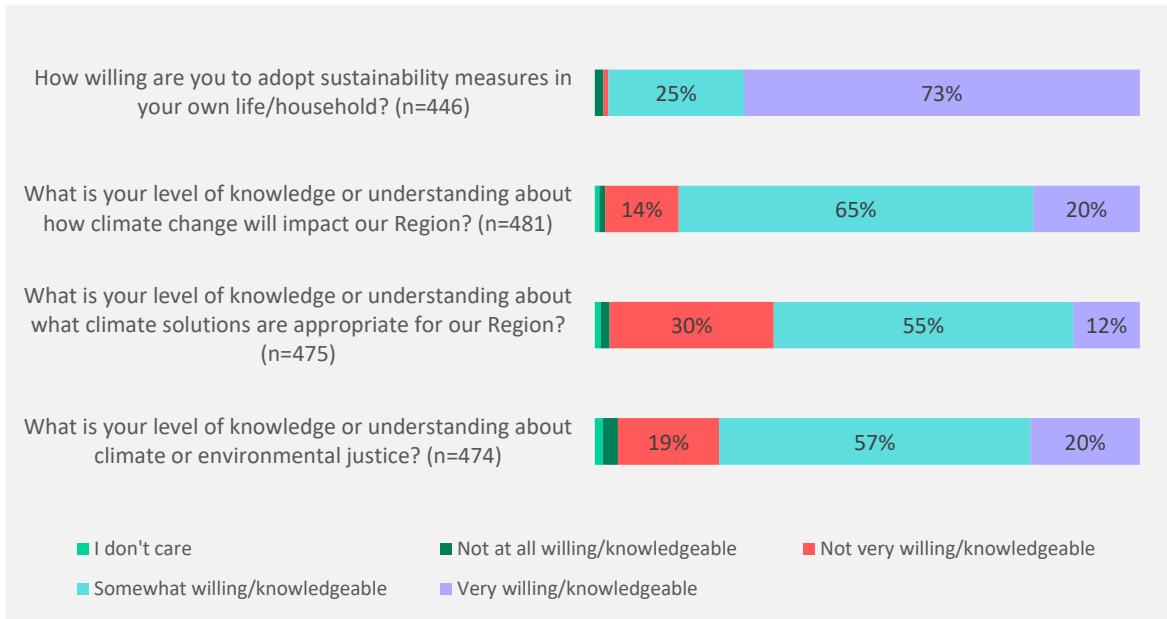
*Figure 3: Climate change awareness in the Region*

*Table 2: Priority areas identified from the online survey*

| Top 3 survey answers per question |
|---|
| **Top 3 priorities for the region[1]** |
| • Affordable Housing (*126 ranked as priority #1*)<br>• Access to Clean Water *(79 ranked as priority #1)*<br>• Criminal Justice/Police Reform (*74 ranked as priority #1*) |
| **Top 3 solutions reduce greenhouse gas emissions and provide community benefits[2]** |
| • Agricultural practices that can increase agricultural yield and the availability of nutritious food while improving water quality of nearby waterways (*121 ranked as the top solution*)<br>• Clean energy job opportunities that improve our infrastructure and provide above average wages and benefits (*98 ranked as the top solution*)<br>• Active transit opportunities (e.g. bike lanes and sidewalks) that improve air quality by reducing the need for fossil fuel vehicles and improve the walkability of our communities (*84 ranked as the top solution*) |
| **Top 3 measures for residential energy efficiency** |
| • Increase financial incentives for weatherization (e.g. insulation and air sealing) and clean heating and cooling technologies (i.e., heat pumps). (*n=203*)<br>• Require landlords to meet energy efficiency standards to receive a certificate of occupancy for a property. (*n=100*)<br>• Educate property owners about the importance of reducing energy use and the availability of programs that can help them reduce energy usage. (*n=65*) |
| **Top 3 preferred transit measures for the region** |
| • Expanding the geographic reach and efficiency of public transit (*n=217*) |

| **Top 3 survey answers per question** |
|---|
| • Expanding access to electric vehicle charging stations (*n=109*) |
| • Expanding sidewalks and pedestrian plazas to create safer, more walkable communities (*n=68*) |
| **Top 3 preferred land and development measures for the region** |
| • Inter-municipal and regional community planning that designates priority development and conservation areas, curbs inefficient development and over-development, revitalizes cities and villages, and preserves open space and agriculture (*n=262*) |
| • Overhaul current zoning codes and rules to increase flexibility, innovation, and access (*n=66*) |
| • High-density development that makes alternative transit (e.g., walking, biking, and public transit) more feasible, and preserves open space and agricultural lands (*n=61*) |
| **Top 3 preferred agricultural practices for the region** |
| • Provide payment to farmers for ecosystem services (e.g., carbon sequestration, soil health, pollinator services, improving water quality) (*n=148*) |
| • Co-developing agricultural land for renewable energy projects (e.g., solar and wind projects) and agricultural production (e.g., sheep farming, beekeeping, fruit and vegetable production) (*n=138*) |
| • Convert waste to energy by using animal and crop waste to create biogas for electricity (*n=49*) |
| **Top 3 perceived barriers to the implementation of climate solutions** |
| • Public perceptions that the costs associated with addressing climate change exceed the benefits of taking action. (*n=153*) |
| • Lack of political will and community leadership in prioritizing climate change in our community. (*n=147*) |
| • Lack of knowledge about local climate change impacts and potential solutions. (*n=95*) |
| **Top 3 preferred sources of funding for climate solutions in the region** |
| • Corporations should pay a carbon fee or taxes for greenhouse gas emissions. (*n=216*) |
| • The government should prioritize funding for climate solutions without raising taxes. (*n=106*) |
| • The government should raise taxes to fund climate solutions. (*n=45*) |
| **Top 3 changes required to address climate change in the region** |
| • Education. People do not understand what needs to be done to address climate change. (*n=137*) |
| • Laws. People will not take action to address climate change unless required. (*n=106*) |
| • Leadership. People are hesitant to take action because they do not want to be the first in their communities to do so. (*n=82*) |
| **Top 3 barriers to implementing sustainability measures in one's own lifestyle/ household** |
| • I do not have the necessary financial resources to implement sustainability measures. (*n=169*) |
| • I already take advantage/implement the full range of sustainability measures. (*n=112*) |
| • I do not have the necessary knowledge to implement sustainability measures. (*n=102*) |

[1] Renewable energy development and racial justice received the top votes overall, but very few ranked these as priority #1.

[2] Land use planning decisions received the most votes overall, but few ranked it as priority #1.

## 2.2 Focus groups (May – October 2021)

The following community groups were consulted via virtual meetings to get input for the climate action plan. Each group was prompted to discuss existing community assets, their vision for an equitable and sustainable community, potential solutions and the barriers that exist that prevent implementation of these solution (technical, political, behavioural or financial).

1. Color Your Community Green Group (May 15th, 2021)
2. Rural residents (June 22nd, 2021)
3. College Students (July 1st, 2021)
4. Health experts (July 13th and July 27th, 2021)
5. Urban Black community members (July 17th, 2021)
6. Clean Tech/Manufacturing organizations (July 20th, 2021)
7. Equity and Non-Profit focused civil society groups (July 26th, 2021)
8. Economic Development Workforce (July 27th, 2021)
9. High School Students (July 28th, 2021)
10. Urban Latino community members (August 4th, 2021)
11. Housing experts (August 16th, 2021)
12. Indigenous community members (August 18th, 2021)
13. Farmworkers (September 17th, 2021)
14. Transportation experts (October 1st, 2021)
15. Municipal Leaders (October 18th and October 25th, 2021)
16. Farmers (February 17th, 2022)

The focus group discussions were transcribed and then coded to determine each group's vision for the community, values, what they said as viable solutions for the area as well as perceived challenges. The results from the focus groups were taken into consideration when selecting solutions for our climate scenarios. For instance – since public transportation and electric vehicles (EVs) were perceived as viable solutions by many groups our climate action scenarios for EVs and public transportation were more ambitious.

Highlights from the focus groups are provided in Table 3. All of the groups shared common elements in their vision for the region, including close-knit walkable and bikeable communities with more green space and year-round, affordable, locally grown foods. Renewable energy and affordable, energy efficient housing for all are also key to reducing greenhouse gas emissions, however in addition to financial support, significant training and growth of the clean energy workforce is necessary for this to happen. Aligning land-use planning with transit and agricultural needs were also mentioned by many groups, requiring extensive collaboration across sectors, neighborhoods, municipalities, counties and businesses.

Shared values identified across each group include connectedness, community, collaboration, equity, justice, affordability, inclusion and accountability.

*Table 3: Highlights from focus groups*

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| **Urban Latino Community Members** (August 4th, 2021; 6 attendees) | | | |
| • Safe and walkable / bikeable neighborhoods<br>• Healthy air; reduction of respiratory illnesses from air pollution<br>• Attractive community (parks, green spaces, artwork) | • More stable and secure society<br>• Cleanliness and respect for nature<br>• Accountability<br>• Inclusivity and representation<br>• Building community | • Energy efficiency<br>• Redevelopment of vacant lands<br>• Build more parks and green spaces<br>• Smart landscaping<br>• EV charging stations<br>• Bicycle lanes<br>• Glass bottle exchange over plastic bottles<br>• Reduce light pollution | • Funding for energy efficiency<br>• Landlords don't have incentive for energy efficiency<br>• Fear of walking because of safety<br>• Lack of community engagement<br>• Need to offer climate communications in multiple languages |
| **Urban Black community members** (July 17th, 2021; 7 attendees) | | | |
| • Fossil free society<br>• Better public transportation<br>• Access to healthcare and local/home-grown nutritious food<br>• Connected community<br>• Clean air and water<br>• Access to education, decent and affordable housing<br>• See night sky, hear nature, be around nature and green spaces<br>• Quality time with family and friends<br>• Feel safe | • Justice<br>• Peace<br>• Accountability through love, particularly by police<br>• Collective consciousness, shared beliefs / ideas / moral attitudes<br>• Sharing food, resources – building community | • Partner with community to solve problems, for example create a Standing Office of Neighborhood Safety<br>• Provide living wages<br>• Improve public transport<br>• Cheaper EVs | • Affordability concerns<br>• Lack of access<br>• Structural inequalities such as racism<br>• Extreme weather events (flooding, drought, polar vortex, extreme heat) |
| **Transportation experts** (October 1st, 2021; 9 attendees) | | | |
| • Quality, higher density housing and mixed-use districts near transit nodes and corridors<br>• Bikeability and walkability | • Equity<br>• Land use planning, including limiting job sprawl, aligning with public transit needs | • Mandatory infrastructure for biking and walking<br>• Cheaper public transit and bikeshare | • More gov't funding for biking, walking and public transit infrastructure |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Safe bike routes<br>• Public transit system that is nearby, affordable, accessible, frequent and robust. Provides similar travel times as driving.<br>• Healthy air | • Regional, municipal and sectoral collaboration. Align planning across different levels.<br>• Public transit has similar priority to EVs | • EV buses<br>• Expand electric car share<br>• Improving bus / transit shelters<br>• Public relations to support public transport uptake<br>• More staff; engineers and architects<br>• No new gas stations<br>• Prioritize corridors where bus routes can be aligned<br>• Limit economic development outside transit corridors via tax incentives.<br>• Identify metrics and goals for public / active transport | • More funding and staff for inspection and enforcement of regulations<br>• Will EV funding divert funding from public transportation?<br>• NIMBY-ism towards higher density<br>• Gentrification concerns<br>• Car-culture in the area<br>• Fear of renters / landlords affecting zoning of higher density areas<br>• Reversing red-lining |
| **Rural residents** (June 22nd, 2021, 10 attendees) | | | |
| • Forests and carbon removal through trees<br>• Protection of natural resources and lands including water bodies and forests<br>• Alternate transit options (bikeability, walkability, snow mobiles)<br>• Regionally- connected communities, such as through trail towns<br>• Farm-to-table<br>• Regenerative farming | • Close-knit community<br>• Agriculture as part of the community and environmental / climate stewards<br>• Land use planning revolving around building community | • Geothermal heat pumps<br>• Light-rail to Rochester; train to Letchworth<br>• Plant trees<br>• Water efficiency measures (low-flow fixtures)<br>• Electrification of homes<br>• More local events | • Algal bloom<br>• Sprawl<br>• Abnormal weather events (i.e., droughts, late snow)<br>• Tree removal (deforestation) for agricultural land<br>• Land acquisition for renewable energy<br>• No big movement towards regenerative farming<br>• Car-centric culture |
| **Color Your Community Green** (May 15th, 2021) | | | |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Elimination of poverty<br>• Green jobs, education and apprenticeship programs<br>• Everyone is well informed on climate issues and solutions<br>• Grow your own food or access to local farms with healthy food<br>• Dense urban areas with walkable commons and liveable centre; less cars<br>• Mixed urban areas with trees and native plants everywhere<br>• Solar panels everywhere<br>• Dedicated community services<br>• Community gatherings (festivals, markets) | • Equity<br>• Environmental Justice<br>• Longevity and sustainability<br>• Inclusivity<br>• Local<br>• Connectedness<br>• Building community | • Electric school buses<br>• Clean energy for buildings<br>• Sustainability and climate change in curriculum<br>• Carbon price or social cost of carbon included in price of goods<br>• Connect with UofR engineering/health programs to get kids involved | • Existing school bus contracts limits ability to change to EV<br>• Green gentrification<br>• Partisanship and politics<br>• NIMBYism<br>• People do not see climate change as a problem or see it as someone else's responsibility<br>• People do not see how climate goals align with other community goals |
| **College Students** (July 1st, 2021; 10 attendees) | | | |
| • Frequent, reliable, affordable, accessible public transport<br>• More bikeability and access to bike trails and paths<br>• Renewable energy (solar PVs, wind turbines, geothermal) and electric (EVs, planes)<br>• Less resource waste through recycling, composting, rainwater harvesting, or natural plastics<br>• More trees, green spaces and biodiversity | • Peace of mind - no fear of climate apocalypse<br>• Collective responsibility - less individualism<br>• Diversity<br>• Equal opportunities<br>• Accessibility | • Functioning bus stop apps<br>• Biodiverse yards with pollinators<br>• Building biking infrastructure (such as bike paths)<br>• Sidewalks for walking<br>• Approve fewer permits for new buildings in places of thriving ecosystems<br>• Clean and sanitary buses<br>• UofR Office of Sustainability | • Politics; need more representative government<br>• Individualistic attitude<br>• Car-centric culture<br>• Public transit is not affordable for all<br>• Public transit does not go everywhere – people are unable to get to the doctor's<br>• Food desert (lack of access to food for people without cars) |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Access to local food from community gardens | | | |

**Health experts** (July 13th and July 27th, 2021; 8 attendees)

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Affordable housing with proper heating and cooling systems for climate change<br>• Safe, accessible rural transportation systems to cities to access healthcare services<br>• Public transit, bike paths, sidewalks, snowmobile paths<br>• Access to low-cost, local, organic, nutritious foods, such as through community gardens<br>• Community hubs for climate resiliency for all (emergency, off-grid power and heating/cooling centres) | • Proactive – addressing climate change reduces health issues<br>• Climate resiliency<br>• Community resiliency<br>• Cross-sector collaboration<br>• Access to healthcare by all | • Emergency power systems (off-grid solar or charging stations)<br>• Create bike lanes and sidewalks during road repair<br>• Media coverage and general awareness linking climate and health<br>• Use schools as community hubs during extreme weather events<br>• Better pay for healthcare workers | • Climate impacts on health (extreme heat or cold). Extreme heat linked to poor mental health, lower distress tolerance.<br>• Consolidation of health services – less community resiliency.<br>• Lack of access to primary care. Poor public transit. Adverse weather affects ability to travel to appointments.<br>• Air quality concerns on health (asthma, allergies)<br>• Lack of funds<br>• Need institutional leaders / decision-makers to be part of the climate conversations. |

**Clean Tech/Manufacturing organizations** (July 20th, 2021; 7 attendees)

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • The region is a clean-tech manufacturing hub (heat pumps, energy storage, solar panels, etc.)<br>• Products that are based on recycled or renewable resources, and are biodegradable. Closed loop systems; circular economy.<br>• More renewable energy (solar, biogas, RNG) | • Holistic climate solutions<br>• Collaborative - organized supply chain; businesses working together<br>• Circular economy<br>• Working within the existing market<br>• Regenerative community | • Regenerative agriculture<br>• Put solar on available rooftops, canopy parking, other underutilized spaces, agro-voltaics<br>• Provide technical/legal/financial services to help with grid interconnection.<br>• Cap grid interconnection costs<br>• Social media, education awareness on climate solutions | • Grants, incentives, subsidies<br>• Payment for carbon capture doesn't include composting, landfill gas capture, etc.<br>• All solar projects need to connect to the grid. Interconnection is difficult, lots of paperwork, costly.<br>• Composting in anaerobic digesters has emissions related |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Efficient, sustainable industrial processes<br>• Natural climate solutions for carbon removal (e.g., soil carbon sequestration) | | • Rainwater harvesting<br>• Carbon pricing/tax on fossil fuels<br>• Lifecycle assessment of RE and other solutions<br>• Set standards for RE companies<br>• Local heat pumps or solar panels; organize supply chain for RE<br>• Landfill capturing methane<br>• 2 turbine systems in every SUNY school<br>• PACE financing for RE | to trucking compost – needs to stay local<br>• Certifications and regulatory concerns with products<br>• Concerns that solar panels on farms will put runoff into creeks and water bodies – need to consider site design. |
| **Equity and Non-Profit civil society groups** (July 26th, 2021; 9 attendees) | | | |
| • Create clean energy jobs in the region for heating, cooling, solar installations, etc.<br>• Affordable housing with proper heating and cooling system, especially for disabled homes<br>• Equitable transit system with better coverage<br>• Food security through climate resilient food production and distribution system; affordable and nutritious food available for all<br>• Access to information, transportation, healthcare, medication and housing needs for most vulnerable communities and people, especially during climate-related emergencies | • Equity and access<br>• Climate equity and justice<br>• Climate resiliency<br>• Emergency preparedness<br>• Disability justice<br>• Community networks and coordination<br>• Public and community-centred land use<br>• Everyone has what they need (food, medication, healthcare, education, housing, etc.) | • Community energy – lowers energy bills, revenue back to community<br>• Partner with community gardens to have another avenue for local food<br>• Go to the community and share knowledge, rather than waiting for people to come to us – tables on the street, parks, markets, etc.<br>• Utilize existing, yet unused, rail lines. For example, electric trains.<br>• Improve transfer system on buses. Balance between more stops and more direct buses.<br>• Improve school curriculum to include climate change<br>• Government funding for affordable housing | • Rooftop solar is cost prohibitive.<br>• Underfunding of schools and communities/people vulnerable to climate change<br>• Heavy reliance on donations from local farmers for food; concerns that climate change will affect agricultural yields<br>• Caregiver shortage within disabled community<br>• Gentrification<br>• People don't believe in climate change; marginalized people are not included in conversation |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| **Economic Development Workforce** (July 27th, 2021; 5 attendees) | | | |
| • Access to resources to start businesses, particularly in low-income neighborhoods<br>• Everyone has job security and have equal opportunities to jobs that are accessible<br>• Employers assist employees with childcare, transportation, encourage time off<br>• Access to affordable, accessible retraining programs<br>• Everyone has access to basic needs to live without worrying (basic income, living wage, technology, | • Equitable solutions<br>• Equitable processes (inclusion and engagement)<br>• Social justice<br>• Widespread awareness and opportunities<br>• Collective investments by communities and neighborhoods<br>• Leverage next generation of leaders | • Tax credits to help homeowners "green" their homes with green tech (solar panels, new windows)<br>• Pay a living wage to everyone ($20-$25 per hour)<br>• Set up governing bodies among neighborhoods to allocate savings from green energy. For example, a green energy training funded by community solar revenue<br>• Affordable training programs - "earn as you learn" or use federal funding to pay people to do training<br>• Generate awareness on clean energy job opportunities; target low-income neighborhoods and individuals from non-traditional educational backgrounds<br>• Feeder programs from schools to jobs<br>• Alleviate technological divide – free laptop and wifi for every person<br>• Carpooling incentives, such as special parking spots<br>• Require developers to build energy efficient buildings (building code) | • General misconception about clean energy jobs - people think that they have to go to RIT to learn this<br>• Training programs are not affordable. Systemic disincentives for training (cost, transportation, childcare) |
| **High School Students** (July 28th, 2021; reps from 8 schools) | | | |
| • More trees, parks, gardens, cleaner areas | • Sense of togetherness<br>• Collaboration | • Bike/skateboard paths | • Climate change is already happening here. Changes in |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Fossil free society, more solar, wind and hydropower<br>• Alternative transport (bikes, electric longboards) that is safe and accessible<br>• Improved public transit with shorter distances, subway<br>• Jobs along transit corridor and downtown<br>• Programs for youth | • Empathy<br>• Caring<br>• Safety | • Courses for helping the community and environment, and green jobs<br>• Colleges with environmental clubs<br>• Gardens in prisons<br>• Tailor school curriculum towards individual interests, including climate change and climate jobs<br>• All electric vehicles | weather, cold spells, more hot days<br>• Stigma against 'green'; people with privilege don't want to change<br>• Lack of jobs downtown<br>• Public transportation is inefficient – need to go downtown first to go elsewhere |
| **Housing experts** (August 16th, 2021; 8 attendees) | | | |
| • Everyone has access to affordable, habitable, democratically managed, public housing. The housing is also close to grocery stores, public transit, green space, bike paths, schools, etc.<br>• Everyone is aware of climate solutions for their homes.<br>• Energy efficiency in all rental properties<br>• Availability of training programs in clean energy and energy efficiency.<br>• Sufficient number of local contractors are trained in clean energy and energy efficiency and have access to materials (plumbers, HVAC, electricians, engineers, etc.) | • Community ownership<br>• Affordability (affordable housing)<br>• Healthy standard of living<br>• Health and safety of renters/tenants | • Use lessons from lead safety policies for implementing energy efficiency programs<br>• Codes/standards for energy efficiency, including insulation and heat pumps on all rental properties.<br>• Standards for maximum energy usage per square foot as part of renewing certificate of occupancy<br>• Relief from heat considered as a standard (heat sequestering to lower heat index in concentrated urban areas)<br>• Assess models of ownership and governance include public housing, community land trusts, cooperative housing, and mutual housing associations | • Low-income households often don't use heating and cooling – worried about high energy bills,<br>• Renters often live in homes with poor insulation. Renters rely on landlords to buy energy efficient equipment, improve weatherization, insulation, etc.<br>• Insufficient contractors<br>• Is the grid capacity sufficient to handle additional electricity load from electrification?<br>• Shortage of housing and affordable housing. Will need additional housing for migrants and climate refugees |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| | | • Use ARP dollars (or other subsidies) to make homes more efficient. Heat pumps for all. | |
| **Indigenous community members** (August 18th, 2021; 5 attendees) | | | |
| • Live our promise to take care of Mother Earth for the future. Have a pristine environment. Protect the water. Protect ancestral lands.<br>• Live off the land. Agriculture is self-sustainable; community food supply year-round<br>• Decentralized energy sources, or use of renewable resources like geothermal<br>• Buildings are designed to have natural, passive forms of heating and cooling (like an Earth ship) | • Connection to nature, hands-on learning<br>• Indigenous mindset<br>• Social justice<br>• Peace<br>• Healing<br>• Kindness<br>• Empathy<br>• Appreciation<br>• Community<br>• Inclusion | • More people grow their own food, greenhouses<br>• Water restrictions (like Genesee County)<br>• Every house on/off reservation to use solar and geothermal energy<br>• Proper assessment for siting of solar farms, wind turbines and industries – no siting near ancestral territories or another's territory.<br>• Protect Great Lakes – violation if water from Great Lakes goes out of state.<br>• Water permits to limit water-taking from large companies and prevent toxic dumping in water bodies.<br>• Children education is more hands-on, in nature, to motivate them to want to protect it. | • Those that live off the land are vulnerable to climate impacts<br>• Higher probability of zoonotic diseases as animals live closer to humans due to land use change<br>• Politicization of environmentalism<br>• Disbelief in climate science<br>• Disbelief in science comes from deep hurt from past colonization, residential schools<br>• Capitalism – who benefits from solar energy, etc. focus on reducing energy consumption |
| **Farmworkers** (September 17th, 2021; 12 attendees) | | | |
| • Protected environment – take care of land like its your house<br>• Recycle and reuse materials, less meat consumption, water use (especially bottled water), material consumption | • Worker rights<br>• Justice for immigrants<br>• Less materialism and consumerism<br>• Work-life balance; spend time with family and friends<br>• Slow down | • Encourage people to fix broken items, instead of replacing them<br>• Employers to encourage better work-life balance; reduce work hours to spend time with family | • Convenience-based, materialistic lifestyles which creates waste<br>• Rely on children/next generation to make changes<br>• Owners do not fix homes |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| • Renewable energy<br>• Less pesticides and chemical fertilizers and related cancer<br>• Liveable wage to cover health costs and other basic needs<br>• Affordable, decent housing<br>• Better transit, bikeability<br>• Access to public spaces, more public spaces<br>• More leisure time | • Representation<br>• Inclusiveness<br>• Empathy | • Quality over convenience – reduce waste. | • More allergies, possibly related to environmental issues (water, climate)<br>• Work more to provide good life for family; no time to spend with family – vicious cycle |
| **Municipal Leaders (October 18th and October 25th, 2021; 13 attendees)** | | | |
| • Bikeability (comfortable, safe)<br>• Walkability (safe routes)<br>• Communities across the region share resources and ideas<br>• Proper land use planning for development. Prime agricultural lands are not converted. | • Sustainability as a priority<br>• Shared goals<br>• Accountability<br>• Collaboration | • Development of a climate plan that has clear metrics and measures<br>• Make it easy for town board to take action through up-front research/knowledge exchange<br>• Convert gov't fleet to EV<br>• LED street lighting<br>• Streetscapes<br>• Canal trail programs<br>• Community Choice Aggregation<br>• Education and awareness on climate change issues in the region | • More climate discussions need to occur at the county level<br>• Lack of support for small towns <50,000 people (technical, financial, admin)<br>• Many aren't convinced climate change is an issue; sees money spent as wasteful<br>• Urban Sprawl<br>• Need funding for EV chargers<br>• Unsure about viability of electrification |
| **Farmers (February 17th, 2022; 10 attendees)** | | | |
| • Improved soil health and access to water<br>• Net zero by dairy industry; energy producers<br>• Land use planning for development. Prime agricultural lands are not | • Value soils<br>• Farmer justice – farmer control over control by large corporations<br>• Farmer welfare<br>• Look at all sectors together | • Peer-to-peer farmer education on soil health practices<br>• Connect farmers to consumers<br>• Payment for ecosystem services & other incentivization mechanisms for soil health practices | • Consider net zero for dairy industry before thinking about just transition.<br>• Farmers need more financial support for manure management practices |

| Visions | Values | Solutions | Challenges/Concerns |
|---|---|---|---|
| converted. Land is affordable for young/minority farmers.<br>• Urban support for local farms | | • Pilot community composting; subsidies for composting<br>• Use cover crops as feed | • More support for small farmers<br>• Concern that soil health does not have same priority as RE |

## 2.3 Scenario analysis workshop (August 2021)

A scenario analysis workshop was conducted in August 2021 following the completion of many of the focus groups. The output from the focus groups suggested that transportation, housing, food and energy were top interests for the area with access to nutrition, affordability, urban sprawl and equity being issues that cut across all interest areas.

We conducted a 3-hour online workshop with participants from various sectors and community groups to understand which solutions to prioritize for each interest area. During the workshop we presented highlights from our focus group discussions including overlapping visions, values and solutions. We then split the participants into breakout groups for each interest area – transport, housing, food and energy. The participants in each group discussed solutions for the region for their specific interest area. The breakout groups were then mixed together, and the new breakout groups discussed the cross-cutting issues – equity, access, affordability and sprawl with a goal to provide coherent next steps for the region that addressed all areas of interest.

The results of the discussion are summarized below:

### 2.3.1 Housing

**Opportunities**

- Conversion of office buildings downtown to residential units to promote vertical growth
- Encourage mixed residential zoning in areas traditionally limited to single family homes
- The region can increase its population, take in climate refugees, migrants, and others through higher density housing.
- Fix tax credits for mixed use, green rehabilitation, green building codes
- Align incentives for landlords and city
- Create jobs and training opportunities in green construction for housing
- Cap rent increases and prioritize ownership
- More weatherization – radiant heat under streets
- Public green spaces to improve heat islands and improve attractiveness

**Tensions**

- School taxes shouldn't be tied to property ownership - creates an equity issue between schools and in education
- Currently weatherization grants are tied to income level

### 2.3.2 Transport

**Opportunities**

- Bike paths which are safe and connect to public transport
- Elevated walkspaces for major intersections although this is not a priority for this region
- Access to rural areas
- Bus cubes and shelters for comfortable ridership
- Link Toronto to NYC via Western NY Cities to provide economic boom
- Increase EV charging station infrastructure

**Tensions**

- Rural areas require more reliance on cars and harder to provide public transit options that can reduce emissions.
- Weather is a challenge – biking, waiting at bus-stops are more uncomfortable during winter

### 2.3.3 Food/Agriculture

**Opportunities**

- Reducing the distance food travels to get to our plates. Allow schools and hospitals to establish better connections to local farmers.
- Location for alternative energy sources often has an impact on agriculture if those are placed on farm land, but it can also provide financial benefits to struggling farms. Can we consider rooftop solar as an option to address land use?
- Community gardens to lower food scarcity

### 2.3.4 Energy

**Opportunities**

- Use small-scale distributed options
- Genesee River for hydroelectric power - keep using what is available
- Solar panel on every roof in the region

**Tensions**

- Lack of transparency about how decisions are being made; municipal leaders in rural areas receiving templated solutions from state
- Rural areas are seen as places of extraction, not as a resource; no meaningful consultation or consideration for indigenous communities; only options are large-scale utility projects

# 3 Regionally relevant climate policies and plans

In addition to solutions identified by stakeholders, existing policies and plans were reviewed for solutions that are already in place to lower emissions in the region. Relevant local, regional, state-level and federal policies are summarized below.

## 3.1 Local/County

**City of Rochester's Climate Action Plan (2017):** The City of Rochester's Climate Action Plan was endorsed by the city council in May 2017. The goal of the plan is to reduce greenhouse gas emissions by 40% by 2030. To do so the plan has identified implementation actions that align with the 2013 Finger Lakes Regional Sustainability Plan.

**City of Rochester's Climate Vulnerability Assessment (2018):** The City of Rochester conducted a climate vulnerability assessment to investigate baseline and projected climate conditions in the area and understand how climate change will affect the community, infrastructure and natural resources.

**City of Rochester's Climate Resilience Plan (2019):** The City of Rochester's Office of Energy and Sustainability developed a community-wide Climate Change Resilience Plan to enhance the city's ability to withstand the impacts of climate change. This plan builds on the findings from the Climate Vulnerability Assessment.

**Village of Fairport's Sustainability Plan (2010):** The Village of Fairport's sustainability plan outlines strategies for the village government and community to maximise their resources and increase the quality of life in the village.

**Green Genesee/Smart Genesee Plan and Resiliency Plan (2021):** The Green Genesee/Smart Genesee is a science based, community led sustainable land use planning project that can be used to strengthen comprehensive planning and land use regulation in Genesee County.

**Monroe County Climate Action Plan (2020):** The Monroe County Climate Action Plan provides steps to improve resiliency towards climate change in Monroe County as well as alternative policies and practices to reduce emissions in the area. The plan calls for climate change planning to be integrated into other planning and decision-making processes in the county.

**Brighton Climate Action Plan (ongoing):** The Brighton Climate Action Plan (CAP) aims to identify climate resilience initiatives in alignment with New York State's Climate Smart Communities objectives in order to maximize positive outcomes for the Town of Brighton. The CAP will identify greenhouse gas and energy reduction goals for the community as well as activities to achieve these goals.

## 3.2 Regional

**Finger Lakes Regional Sustainability Plan (2013):** The Finger Lakes Regional Sustainability Plan outlines actions for improving the long-term sustainability of the nine-county region. The plan identifies current greenhouse gas emissions and natural resource use and then outlines strategies for greenhouse gas emission reduction and the deployment of renewable energy sources. The plan also identifies sustainability goals for energy supply, water and waste management, housing, etc as well as actions to achieve these goals and barriers to implementation.

**Genesee Finger Lakes Transportation Plan (2021):** The Long Range Transportation Plan for the Genesee-Finger Lakes Region 2045 (LRTP 2045) establishes transportation priorities and provides directions for transportation policy, planning, and investment decision making for the Genesee-Finger Lakes Region. The plans seeks to advance regional transportation needs such as improved safety and expanded accessibility while safeguarding environmental resources.

**Regional Transit Service (2021):** According to the Regional Transit Service (RTS) 2021-2024 Comprehensive Strategic Plan, 25% of the RTS bus fleet to be EVs by 2025 and 100% by 2035.

## 3.3 State-level

**Climate Leadership and Community Protection Act (2019):** New York state has set statutory targets to reduce greenhouse gas emissions to 40% below 1990 levels by 2030 and no less than 85% below 1990 levels by 2050. The targets also aim for net-zero greenhouse gas emissions by 2050 and that 70% or all electricity generated in New York be renewable by 2030. The CLCPA also set up a Climate Action Council tasked with developing a Climate Action Plan for New York to achieve its CLCPA targets.

**Climate Action Plan Scoping Report (2022)** – New York States Climate Action Council released a draft scoping plan for how the state can achieve the targets outlines in the CLCPA. The plan calls for eliminating the use of fossil fuels in new home construction by 2025 and prohibiting fossil fuels in commercial buildings and multi-family homes by 2030.

**Regional Greenhouse Gas Initiative (RGGI):** New York is a participant in the Regional Greenhouse Gas Initiative (RGGI). RGGI is a cap-and-trade program to reduce $CO_2$ emissions from power plants. RGGI required that all fossil fuel-fired power plants with a capacity of 25 MW of higher be required to obtain an allowance for every ton of carbon dioxide that they emit annually. Each of participating states has set a goal of reducing emissions an additional 30% compared to 2020 levels by 2030.

**Clean Energy Standard (2016):** New York adopted a clean energy standard which requires 50% of the electricity consumed in the state to come from renewable energy sources by 2030.

**Zero emissions cars and trucks (2021):** New York adopted assembly bill A.4302/S.2758 that states that 100% of all new sales of passenger cars and trucks will be zero-emissions from 2035, medium-duty and heavy-duty vehicles by 2045 and off-road vehicles and equipment by 2035.

**Building electrification (2022)**: In January 2022, Governor Hochul announced plans for 1 million electrified homes and 1 million electrification-ready homes by 2030 (approximately 3 million households in NY State) and zero-emissions construction by 2027.

## 3.4   Federal

**NHTSA's Corporate Average Fuel Economy (CAFE) Standards:** National Highway Traffic Safety Administration's (NHTSA's) Corporate Average Fuel Economy (CAFE) standards regulate the average distance vehicles must travel on a gallon of fuel.  As per the 2021 rule, the standards require an industry-wide fleet average of approximately 49 miles per gallon (mpg) for passenger cars and light trucks in model year 2026 which is to be achieved by increasing fuel efficiency by 8% annually for model years 2024 and 2025, and 10% annually for model year 2026.

**Greenhouse gas emission standards for passenger cars and light truck 2021-2026:** The final rule (effective Feb 2022) puts in place standards that increase in stringency year-over-year by 10% in model year (MY) 2023, 5% in MY 2024, 6.6% in MY 2025, and by more than 10% in MY 2026. This would effectively mandate that electric vehicles increase their market share from 7% in 2023 to about 17%.

**USDA's Climate-Smart Agriculture and Forestry Strategy:** The USDA's Climate-Smart Agriculture and Forestry Strategy outlines practices to decrease wildfire risk, source sustainable bioproducts and take conservation actions that reduce carbon emissions and increase carbon sequestration. Techniques includes ruminant feed management, cover crops, irrigation efficiency, and more.

**US NDC:** Under the USA's Nationally Determined Contribution to the UN Framework Convention on Climate Change (UNFCCC), there is an economy-wide target of reducing the country's net greenhouse gas emissions by 50-52 percent below 2005 levels in 2030.

**DOE Better Buildings, Better Plants:** Better Plants is a voluntary partnership program run by the Department of Energy (DOE). Better Plants works with leading U.S. manufacturers and wastewater treatment agencies to set energy, water, and waste reduction goals, and to commit to reducing energy intensity by 25% over a 10-year period. In return, partners receive technical assistance, tools, resources, and national recognition.

**Clean Air Act (proposed by the EPA):** In 2021 the EPA proposed new rules that would support the use of cost-effective technology in reducing methane emissions. The impact of the rules would be a reduction in 41 million tons of methane emissions from 2023 to 2035.

**USDA Conservation Reserve Program:** CRP is a land conservation program run by the Farm Service Agency (FSA). Farmers enrolled in the program commit to removing environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality instead. In exchange they receive a yearly rental payment.

# 4 Priority areas for emission reductions

The baseline emissions inventory estimated emissions across each sector both historically between 2010-2018 and in the future to 2050 based on historical emission trends.  A summary of the top 15 sources of regional emissions in 2018 is given in Table 4 reflecting 81% of the region's emissions. Climate action around these sources of emissions should be prioritized.

*Table 4: Top 15 sources of emissions in 2018 (in GWP20)*

| Sector | Subsector | Emissions (MMtCO$_2$e) | Share of Emissions (%) |
|---|---|---|---|
| Transport | Light passenger trucks | 4.3 | 16% |
| Agricultural | Enteric fermentation | 3.3 | 12% |
| Residential | Space Heating | 3.2 | 12% |
| Transport | Cars | 2.6 | 10% |
| Agricultural | Manure management | 2.1 | 8% |
| Commercial | Natural gas consumption | 1.1 | 4% |
| Transport | Heavy duty combination trucks | 0.9 | 3% |
| Waste | Seneca Meadows Landfill | 0.8 | 3% |
| Residential | Water Heating | 0.7 | 3% |
| Residential | Other End Uses | 0.7 | 2% |
| Waste | High Acres Landfill and Recycling Center | 0.6 | 2% |
| Commercial | Electricity | 0.5 | 2% |
| Losses | Fugitive Emissions | 0.5 | 2% |
| Waste | Wastewater | 0.5 | 2% |
| Transport | Rail | 0.4 | 1% |
| **Total** | | **22.1** | **81%** |

# 5 Potential mitigation measures

Climate mitigation measures are actions that reduce greenhouse gas emissions. To identify with potential mitigation measures, we used the output from the survey results, focus groups and scenario workshops to analyse what kind of emission reduction measures were in line with the communities needs and wants. We also looked through the existing policy landscape (on a

regional, state and federal level) to see what kind of mitigation solutions are feasible – in that the policies required already exist and there is financial support for their uptake. Finally, we tried to identify measures that addressed the priority areas for emission reduction according to the baseline emissions inventory.

Based on this, the project team came up with a number of potential mitigation scenarios. We divided the measures into technical and non-technical categories. Technical actions were further evaluated in the emissions model developed during the emissions inventory phase of the project to determine the level of emissions reduction potential that these actions could achieve. However, many mitigation measures could not be quantified either because they have not been tried before so their impact on emissions is unknown and it is unclear to what degree they will be successful in this region (for example, shift to plant-based diets, reduced urban sprawl, etc). Many others could not be quantified simply because the data did not exist or was not readily available.

All other mitigation measures were quantified in the emissions model described in detail in the Baseline Emissions Inventory report. The remainder of this section summarizes the mitigation measures that were identified for each sector, and details on how the measures were quantified, and if they were quantified.

## 5.1   Technical measures

### 5.1.1   Energy Systems

**Carbon-free grid** (quantified): According to the Baseline Emissions Inventory report, around 40% of the region's electricity is from fossil fuel sources (natural gas, coal and oil). Most of the major utilities in the region meet their electricity demands through the wholesale electricity market run by the NY Independent Systems Operator (NYISO). NYISO selects the energy mix for utilities based on what is least-cost and available at the time, and despite Upstate NY's clean energy mix, most of the region's needs are met through from the power plant's located Downstate. As a result decarbonization of the state's entire grid is important. Electrification of buildings and vehicles means that there will be increased demand for electricity from the grid in the future. Some of these demands will be offset using more energy efficient equipment. However, decarbonization of the electricity grid is important to meeting emission reduction goals. This mitigation measure assesses the emissions reduction from the state meeting its goal of 100% carbon free grid. Some of the carbon free electricity could be met by renewable energy production in the region, such as rooftop solar, battery storage, community energy, community choice aggregation, and other technologies and policy instruments, however specific measures were not assessed. Instead, the emissions factor for electricity was adjusted to 0 according to the target date for when a carbon free grid is desired.

### 5.1.2   Residential

**Building shell energy efficiency** (quantified): Energy efficiency is the reduction in energy consumption from improvements in infrastructure or technologies. This mitigation measure

evaluates the emissions reduction from improvements to the building shell of a house or residential building. Improvements typically include replacement of old windows with thermal windows, replacement of insulation to reduce air leakage and heat loss, or weatherstripping around doors and windows. These building shell improvements lead to a reduction in heating and cooling needs, thus reducing energy consumption. We used the same assumptions as the NY Climate Action Plan Scoping Report, namely that households either had basic or deep shell improvements, resulting in specific levels of reduction in heating and cooling demands. We used the average reductions in our analysis.

- **Basic Shell Definition**: 27-44% reduction in space heating and 14-27% AC demands
- **Deep Shell Definition:** 57-90% reduction in space heating and 9-57% AC demands

Residential energy intensity for each space heating and cooling technology represents the baseline value from the U.S. Energy Information Administration's (US EIA's) 2015 Residential Energy Consumption Survey, adjusted for climate change impacts. For the building shell measure, we adjusted energy intensity by weighting the energy intensity of inefficient households to households undertaking either basic shell improvements or deep shell improvements. The number of households undertaking building shell improvements was changed under different scenarios, as described in the next section.

**Space heating electrification** (quantified): Residential space heating, largely from natural gas, contributes to 12% of the region's emissions. Electrification, or switching from fossil fuel-based space heating to electric heating, is an important area of climate action. This mitigation measure evaluates the emissions reduction from shifting to electric air-source heat pumps for space heating in households. The emissions reduction would be similar if the shift were to geothermal ground-source heat pumps, though this was not measured at this time. The share of households undertaking electrification are downscaled to each county from the 2030 building electrification targets for NY state set forth by Governor Hochul in early 2022.

**Water heating electrification** (quantified): Residential water heating, largely from natural gas, contributes to 3% of the region's emissions. This mitigation measure evaluates the emissions reduction from shifting to efficient electric heat pumps for water heating in households. The emissions reduction would be similar if the shift were to geothermal-based water heating, though this was not measured at this time. The share of households undertaking electrification are downscaled to each county from the 2030 building electrification targets for NY state set forth by Governor Hochul in early 2022.

**Electrification of other energy services** (quantified): Emissions from other residential end uses, like clothes washing or drying, cooking, refrigeration, electronics, represents 2% of the region's emissions. This mitigation measure evaluates the potential emissions reduction from shifting the use of fossil fuels for other residential end uses to electricity. The share of households undertaking electrification are downscaled to each county from the 2030 building electrification targets for NY state set forth by Governor Hochul in early 2022.

**Appliance efficiency** (not quantified): Federal appliance efficiency standards apply to all new appliances. However, the current model does not disaggregate other energy services into specific appliances, and furthermore the age of those appliances and whether they are high or low efficiency. Therefore, appliance efficiency cannot be measured at this time.

**Water efficiency** (not quantified): While the water heating electrification measure evaluates the shift from fossil fuel-based equipment to non-fossil fuel-based equipment, water efficiency measures can reduce energy demands in households for water heating and by water utilities for water treatment and distribution. It can also help save on water bills. Water efficiency measures include low-flow toilets, low-flow fixtures, or efficient washing machines and dishwashers. See the appliance efficiency measure for details on why this measure not evaluated at this time.

**High density development** (not quantified): The impact of high-density development on energy efficiency cannot be quantified in the current model as the residential sector has not been disaggregated by building type – single detached homes, semi-detached homes, low-rise buildings, high-rise buildings, etc.

**Smart landscaping / native species** (not quantified): The emissions reduction potential from smart landscaping and the reintroduction of native species in residential neighborhoods is unclear.

### 5.1.3   Transport

**Shift to active transit and working from home** (quantified)**:** Active transit options such as walking, biking and skateboarding improve air quality by reducing the need for fossil fuel vehicles. The vast majority of participants would like more walkable and bikeable communities through the expansion of sidewalks, pedestrian plazas, bike paths and trail towns, and through high-density development with houses and workplaces closer to each other. There are also more residents working from home as a result of the COVID-19 pandemic. This measure evaluates the potential emissions reductions from shifting from driving to active transit options or working from home.

**Federal fuel economy standards** (quantified): This mitigation measure evaluates the emission reduction potential from the NHTSA's Corporate Average Fuel Economy (CAFE) standard as described in Section 3.4. The fuel economy, or the average distance vehicles must travel on a gallon of fuel (mpg), for gasoline and diesel vehicles was adjusted according to the targets set in NHTSA's standards.

**Electrification of light-duty vehicles** (quantified): In accordance with the New York assembly bill A.4302/S.2758, this measure assumes that all 100% of all new sales of passenger cars and trucks will be zero-emissions from 2035. The proportion of new vehicles in each year from 2035 onwards are estimated using typical passenger car and truck sales rates for NY state from the NY Climate Scoping Plan. Early retirement of existing vehicles are estimated under some

emission reduction scenarios. For this mitigation measure to occur, there will need to be sufficient expansion of electric vehicle charging stations (both private and public), and incentives for lower income individuals, such as subsidies or tax credits.

**Electrification of medium- and heavy-duty vehicles** (quantified): In accordance with the New York assembly bill A.4302/S.2758, this measure assumes that all 100% of all new sales of medium- and heavy-duty trucks will be zero-emissions from 2045. The proportion of new vehicles in each year from 2045 onwards are estimated using typical medium- and heavy-truck sales rates for NY state from the NY Climate Scoping Plan. Early retirement of existing vehicles are estimated under some emission reduction scenarios. For this mitigation measure to occur, there will need to be substantial investment in electric vehicle charging stations.

**Electrification of public buses** (quantified): This measure follows the targets set forth in the Regional Transit Service (RTS) 2021-2024 Comprehensive Strategic Plan for 25% of the RTS bus fleet to be EVs by 2025 and 100% by 2035.

**Electrification of school buses** (not quantified): The electrification of school buses was mentioned by several participants in the stakeholder consultation meetings. However, currently our model does not disaggregate private buses by type. Since we do not know the proportion of private buses that are school buses, we are unable to determine the emissions reduction from electrifying school buses.

**Shift from light duty vehicles to public transit** (not quantified): It is unclear if public transit ridership will increase in the future from those that previously drove in passenger cars without a significant change in public transit systems. Changes can include expanding the geographic reach and efficiency of public transit, increase in frequency, cheaper fares, improved bus shelters, clean and sanitary buses, functioning bus stop apps, or the improved transfer systems between buses. During the COVID-19 pandemic there was a decrease in ridership and more people working from home. It is unclear to what extent this will persist into the future.

**Carpooling and ridesharing (**not quantified**):** There is insufficient data on the proportion of light duty vehicles used for carpooling or ridesharing with multiple passengers from different households. Ridesharing with multiple passengers from a single household is not considered an emission reduction measure.

**Low carbon fuel** (not quantified): Renewable natural gas (RNG), renewable distillate and hydrogen are considered low carbon fuels. The emissions reduction potential from these fuels were not assessed at this time as hydrogen vehicles are not yet readily available at a commercial-scale, and the characteristics (i.e., fuel economy, emissions) of vehicles that use RNG and renewable distillate are unclear.

**Regional rail systems** (not quantified): Many focus group participants mentioned the possibility for utilizing or repurposing existing, and in some cases, unused, rail lines for public transit systems

across the region. It is worth exploring the technical and financial viability of this option in the future.

### 5.1.4 Commercial

**Building shell efficiency** (quantified): This mitigation measure evaluates the emissions reduction from improvements to the building shell of a commercial building (Office / Government, Retail, Food Service, Grocery, Healthcare, Education, Lodging, Warehouse). Improvements typically include replacement of old windows with thermal windows, replacement of insulation to reduce air leakage and heat loss, or weatherstripping around doors and windows. These building shell improvements lead to a reduction in heating and cooling needs, thus reducing energy consumption. We used the same assumptions as the NY Climate Action Plan Scoping Report as was used for households, namely that buildings either had basic or deep shell improvements, resulting in specific levels of reduction in heating and cooling demands.

- **Basic Shell Definition**: 27-44% reduction in space heating and 14-27% AC demands
- **Deep Shell Definition:** 57-90% reduction in space heating and 9-57% AC demands

We used the average reductions in our analysis. In order to apply the reductions we had to first determine the amount of commercial energy demands that was used for heating and cooling. To do this, we used NYSERDA's 2018 *Commercial Statewide Baseline Study of New York State* to find the square footage of commercial area and estimate the share of commercial energy demands for heating and cooling. We first adjusted the heating cooling demands for climate change impacts, and then for the implementation of building shell measures. The square footage of commercial area undergoing building shell improvements was changed under different scenarios, as described in the next section.

**Building electrification** (quantified): This measure evaluates the potential emissions reduction from electrifying equipment in commercial building. This includes fossil fuels used for space heating, water heating and cooking. Similar to the commercial building shell efficiency scenario, we used NYSERDA's 2018 *Commercial Statewide Baseline Study of New York State* to find the square footage of commercial area and estimate the energy intensity of fossil fuel consumption per sq ft. We adjusted the energy intensity based on the amount of commercial area affected, which varied depending on the scenario analyzed, as described in the next section.

**LED street lighting** (not quantified): Publicly available data on street lighting in each county was not readily found. As a result, street lighting was not included in the emissions inventory and therefore we were unable to measure the potential emissions reduction from switching street lighting to LEDs. Many municipalities noted that they were undertaking this action, so it would be useful to include this measure in the future.

**Schools as community hubs** (not quantified): Many households do not have adequate heating and cooling systems to handle extreme weather events like heat waves and cold snaps. These

events are becoming more common as a result of climate change. Many focus group participants noted how schools could be used as community hubs (heating/cooling centers) during these events. The emissions from this type of action was not measured in this study.

### 5.1.5    Industrial

**General efficiency measures** (quantified): This measure assumes an improvement in efficiency across all industrial sub-sectors per the NY State Climate Scoping Plan. The level of efficiency improvement varies by scenario, as described in the following section.

**Electrification of non-fossil equipment** (quantified): This measure assumes a shift from fossil fuel to electricity across all industrial sub-sectors NY State Climate Scoping Plan. The level of electrification varies by scenario, as described in the following section.

**Process emissions** (not quantified): The NY State Climate Scoping Plan includes emissions reductions from carbon capture and storage (CCS) from cement and iron and steel production. Since CCS is not commercially available at this time, we did not quantify it in this analysis.

### 5.1.6    Agricultural

**Manure management** (quantified): Livestock manure accounts for 8% of the region's emissions. This mitigation measure looks to reduce manure-related emissions through the storage of manure and installation of methane capture systems. This measure assumes that the captured methane is flared, but it could also be used to generate electricity or further processed to create RNG.

**Alley cropping** (quantified): Alley cropping is defined as the planting of rows of trees and/or shrubs to create alleys within which agricultural or horticultural crops are produced. Alley cropping is not common in the region but could have benefits like improved water quality, such as from reduced runoff, in addition to emission reduction. The mitigation potential for the Genesee-Finger Lakes counties has been determined by multiplying the mitigation potential for the state as a whole by the ratio of the crop area in each county to the crop area of New York State under different scenarios.

**Fertilizer Management** (quantified): Fertilizer management results in reduced nitrous oxide emissions (direct and indirect) which can reduce algae blooms. Algae blooms are occurring more frequently among many of the Finger Lakes and Great Lakes. The mitigation potential for the counties in the Genesee-Finger Lakes has been determined by multiplying the mitigation potential for the state as a whole by the ratio of the crop area in each county to the crop area of New York State under different scenarios.

**Alternative fertilizer** (quantified): This measure assumes that the use of synthetic fertilizer is shifted to organic sources including dried manure and activated sewage, which have lower nitrous oxide emissions and reduces water pollution.

**Cover Crops** (quantified): Cover crops are planted in the off-season for the purpose of securing the soil rather than for being harvested, increase organic matter and suppress weed growth. Cover crops can be very useful in Genesee-Finger Lakes region particularly in vineyards. The mitigation potential for the counties in the Genesee-Finger Lakes has been determined by multiplying the mitigation potential for the state as a whole by the ratio of the crop area in each county to the crop area of New York State under different scenarios.

**Alternative livestock feed** (not quantified): Enteric fermentation accounts for 12% of regional emissions. Changing livestock diet through alternative feed has the potential to reduce enteric fermentation. Currently, this is occurring on a farm-by-farm basis as diets are specific to the farm and existing feed practices. While there is ongoing research about alternative diets for dairy cows, such as seaweed, this practice has yet to be scaled up.

**Reduced tillage practices** (not quantified): Reducing tillage decreases soil disturbance and soil erosion. The type of fertilizer used, and the manner in which it is applied, can make or break reduced tillage's ability to control greenhouse gases. Without having a full understanding of existing tillage practices, we were unable to quantify the impacts of reduced tillage.

**Community gardens/year-round greenhouses** (not quantified): Access to healthy, affordable, locally-grown produce has the potential to reduce emissions from transporting food from outside the region and promotes natural carbon removal through the expansion of green space. However, it is unclear the extent of developed areas that could be converted to community gardens. This should be further explored in the future.

**Plant based diets** (not quantified): Action to change consumer behaviour is currently a very sensitive issue. The UK government included changing consumer behaviour to encourage a shift to plant-based diets in their climate plan but had to remove it after facing backlash. While sales of plant-based milk and meats are expected to increase substantially in the next decade or so it is unclear to what extent this will result in a decrease in consumption of dairy and meat products. Our research on dairy consumption over the past five years suggested that although sales of dairy as milk had gone down (as a result of the entry of plant-based milks) dairy consumption overall (cheese, ice cream etc) had gone up. Therefore, the extent of plant-based diets affecting dairy production in the region is unclear.

**Reduction in food waste at the production side** (not quantified): The USDA and EPA goal to reduce food loss and waste by 50% by 2030. Currently 31% of all agricultural products is wasted. By 2030 existing policy aims to bring that down to 15.5%. However, the current rate of food waste in the region is not known.

### 5.1.7    Waste

**Landfill gas capture** (quantified): All of the large landfills in the region have landfill gas capture systems. The reduction in emissions from landfill gas are already incorporated in the baseline scenario.

**Reducing consumption** (not quantified): Most of the goods that we purchase are produced outside of the region, including appliances, vehicles, clothes, etc. The emissions that result from consuming goods are currently not included in the emissions inventory because the amount of goods that were produced from outside the region is not clear.

**Waste diversion** (not quantified): The amount of recycling waste, reusing or fixing goods is not readily available at a county level, and was not quantified at this time. This includes the diversion of food waste to community composting. There is also potential to generate electricity or produce fuel from compost.

### 5.1.8    Land

**Afforestation of Former Agricultural Land** (quantified): This mitigation measure evaluates the potential for emissions removal from the afforestation of former agricultural land. The mitigation potential for the counties in the Genesee-Finger Lakes has been determined by multiplying the mitigation potential for the state as a whole by the ratio of the crop area in each county to the crop area of New York State under different scenarios.

**Parks and green space / urban trees** (not quantified): The extent of developed land or vacant lands that are available for parks and green spaces is unclear. This should be explored further in the future.

## 5.2   Non-technical measures

A summary of the non-technical measures to facilitate emission reduction are as follows:

**Improving living standards for some; reducing consumption for others**: As shown in the Baseline Emissions Inventory report there is a clear connection between income and emissions. Moderate- to high-income households are consuming twice as much energy as lower income households. Addressing inequity is important for reducing emissions. Those that consume more need to heavily invest in energy efficiency and renewable energy. For lower income households, there is concern over living wages, affordable and energy efficient housing, access to healthy food, technological divide, poor transportation options, alongside greater health and livelihood burdens from climate change.

**Education and awareness on climate change**: Many survey respondents noted that they had some knowledge of climate issues but were unclear of how it affected the region and the breadth of climate solutions that were available. Institutional leadership and policymakers often view climate issues as a separate issue, when in reality, it affects every aspect of our lives – where we live, how we live, how we move. More awareness is needed through media, social media, workplaces, as well as improvements to educational curriculum across levels. Hands-on learning is also encouraged to understand the importance of nature to our lives and livelihoods as many of us are disconnected from nature. Peer-to-peer learning is also encouraged.

Municipalities can share their experiences in enacting climate policies, and businesses can share sustainable business practices, farmers can share regenerative agriculture measures.

**Supporting clean energy businesses and training programs**: The energy efficiency and renewable energy needs will not be achieved without a sufficient workforce to do the work. There needs to be substantial investment in supporting entrepreneurs in this area, and building the workforce through affordable training programs, including feeder programs from high schools. There is strong interest in the region becoming a clean manufacturing hub for heat pumps, energy storage, solar panels and more. Plans for the full renewable energy supply chain is needed.

**Funding**: To make the mitigation measures happen, they need to be funded. Financial instruments including subsidies, loans, grants and taxes are necessary. This could include cost on carbon, payment for ecosystem services for farmers to invest in soil health, support for businesses, cap on grid interconnection costs for renewables, financing of energy efficiency projects and more. Funding measures also need to be easily accessible without significant paperwork.

**Codes and standards:** Many examples of potential codes and standards emerged from the stakeholder discussions including updated green building codes, water taking permits, requiring landlords of existing buildings and developers of new buildings to meet energy efficiency standards, limit building permits for new buildings in sensitive ecosystems, ensuring all solar farms/wind turbines/new factories under extensive siting assessments.

# 6 Scenario description

The emissions reduction of each of the above measures are combined with other measures to create a scenario. An integrated framework is adopted that avoids double counting of emission reductions from each measure. For example, if analyzed separately, more efficient cars, lower carbon fuels, and increased non-motorized travel may all avoid the same baseline transportation emissions, thus overstating emission reductions. The analyzed three scenarios building from the baseline scenario developed in Phase 1. The scenario descriptions are as follows and detailed descriptions of the measures and level of ambition is provided in Table 5.

**Existing policies:** Based on our analysis of emission reduction options, we assembled a suite of measures that each county could undertake, with active participation from businesses, residents, and partner institutions and jurisdictions. This first scenario assumes emissions reductions over the baseline scenario expected if current federal, state and regional targets and plans are met in full.

**Existing policies plus low ambition:** Our second scenario (low ambition) postulates further actions by each county beyond the first scenario that seems politically and socially feasible in the short term. We have based our understanding of the feasibility of these measures from the

focus group outputs – specifically the values and visions of the local communities and specific challenges identified as well as what is outlined as feasible in the NY Climate Scoping document. The target goal for this scenario is to meet the 85% reduction in emissions outlined in CLCPA.

**Existing policy plus high ambition:** Scenario 3 (high ambition) is more ambitious measures that need to be taken to go beyond an 85% reduction in emissions by 2050. This scenario helps to elucidate the maximum emission reductions that the Region could achieve.

While ultimately, the scenario analyses will provide useful guidance for evaluating pathways to "close the gap" between the region's projected emissions and the potential climate goals, it will be important to recognize that, given large uncertainties looking out 30 years, these scenarios will not necessarily provide a specific recommended way forward: moving from the visioning of the scenario analysis to the practical elements of strategy development is the role of Phase 3.

*Table 5: Scenario details*

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| **Electricity Generation** | **Generation Capacity** | **GRID1: Carbon Free Grid 2040 -** In line with the CLCPA, this measure seeks to have a carbon free grid by 2040. Emissions produced from Electricity Generation are slowly reduced to 0 tCO2 per unit of energy in 2040. | **GRID2: Carbon Free Grid 2035 -** Going beyond the CLCPA, this measure seeks to have a carbon free grid by 2035. Emissions produced from Electricity Generation are slowly reduced to 0 tCO2 per unit of energy in 2030. | **GRID3: Carbon Free Grid 2030 -** Going beyond the CLCPA, this measure seeks to have a carbon free grid by 2030. Emissions produced from Electricity Generation are slowly reduced to 0 tCO2 per unit of energy in 2030. |
| **Transport** | **Fuel economy** | **CAFE: Fuel Standards -** NHTSA's Corporate Average Fuel Economy (CAFE) Standards | Since it is unclear if the region can influence car manufacturers, a higher ambition scenario is likely not possible. Therefore, we will use the same assumptions as the existing policy scenario. | Since it is unclear if the region can influence car manufacturers, a higher ambition scenario is likely not possible. Therefore, we will use the same assumptions as the existing policy scenario. |
| **Transport** | **Light duty vehicles** | **EVLDV1: EV LDV Scenario Reference -** In accordance with state legislation A.4302/S.2758, this scenario assumes that 100% of all new sales of passenger cars and trucks from 2035 onwards will only be BEVs. | **EVLDV2: EV LDV Scenario Low -** This scenario assumes that through subsidies and other incentives provided by the region, it might be possible for 100% of passenger and truck sales from 2035 onwards to be BEVs, and for 10% of LDVs to undergo early retirement before 2030. | **EVLDV3: EV LDV Scenario High -** This scenario assumes that through subsidies and other incentives provided by the region, it might be possible for 100% of passenger and truck sales from 2035 onwards to be BEVs, and for 25% of LDVs to undergo early retirement before 2030. |
| **Transport** | **Heavy duty vehicles** | **EVMHV1: EV MHDV Scenario 2045 -** In accordance with legislation A.4302/S.2758, this scenario assumes that 100% of new sales of medium and | **EVMHV2: EV MHDV Scenario 2040 -** This scenario assumes that through subsidies and other incentives all new | **EVMHV3: EV MHDV Scenario 2035 -** This scenario assumes that through subsidies and other incentives all new |

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| | | heavy duty trucks from 2045 onwards will only be EVs. | sales of medium and heavy trucks from 2040 onwards will only be EVs. | sales of medium and heavy trucks from 2035 onwards will only be EVs. |
| Transport | Electrification of Public buses | **EVBUS1: Electric Buses -** According to the Regional Transit Service (RTS), 25% of the RTS bus fleet to be EVs by 2025 and 100% by 2035. According to the RTS' 2021-2014 Comprehensive Strategic Plan, it has 395 buses in its fleet. | Since the RTS covers all public buses in the region, the same assumptions as the existing policy scenario are used. | Since the RTS covers all public buses in the region, the same assumptions as the existing policy scenario are used. |
| Transport | Biking/walking/working from home | Same as baseline scenario. | **BIKE1: More Biking 10 -** This scenario assumes that by 2030, 10% of vehicle miles traveled from LDVs will decline due to an increase in biking, walking, and working from home and 20% by 2050. | **BIKE2: More Biking 25 -** This scenario assumes that by 2030, 25% of vehicle miles traveled from LDVs will decline due to an increase in biking, walking, and working from home and 35% by 2050. |
| Residential | Building shell efficiency | **RESSHEL1: Residential Building Shell Reference -** This scenario uses the assumptions from the NY State Integration Analysis reference scenario which says that by 2030, 3% of households will have a Deep Shell and 4% a Basic Shell and by 2050, 5% of households will have a Deep Shell and 10% will have a Basic Shell. A more efficient building shell translates into a | **RESSHEL2: Residential Building Shell Low -** This scenario uses the assumptions from the NY State Integration Analysis scenario 1 which says that by 2030, 3% of households will have a Deep Shell and 10% a Basic Shell and by 2050, 12% of households will have a Deep Shell and 56% will have a Basic Shell. A more efficient building shell translates into a | **RESSHEL3: Residential Building Shell High -** This scenario uses the assumptions from the NY State Integration Analysis scenario 4 which says that by 2030, 7% of households will have a Deep Shell and 18% a Basic Shell and by 2050, 26% of households will have a Deep Shell and 66% will have a Basic Shell. A more efficient building shell translates into a |

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| | | reduction in space heating and air conditioning needs. | reduction in space heating and air conditioning needs. | reduction in space heating and air conditioning needs. |
| Residential | Space heating electrification | **RESSPAC1: Residential Space Heating Electrification Reference** - This scenario is based off of Gov. Hochul's plan to have 31% of NY households electrified by 2030 and continuing at the same trajectory to 2050. | **RESSPAC2: Residential Space Heating Electrification Low** - This scenario is assumes that 50% of households will be electrified by 2030 and continuing at the same trajectory to 2050. | **RESSPAC3: Residential Space Heating Electrification High** - This scenario is assumes that 70% of households will be electrified by 2030 and continuing at the same trajectory to 2050. |
| Residential | Water heating electrification | **RESWATR1: Residential Water Heating Electrification Reference** - This scenario is based off of Gov. Hochul's plan to have 31% of NY households electrified by 2030 and continuing at the same trajectory to 2050. | **RESWATR2: Residential Water Heating Electrification Low** - This scenario assumes that 50% of households will be electrified by 2030 and continuing at the same trajectory to 2050. | **RESWATR3: Residential Water Heating Electrification High** - This scenario assumes that 70% of households will be electrified by 2030 and continuing at the same trajectory to 2050. |
| Residential | Electrification of other energy services | **RESOTHR1: Residential Other Electrification Reference** - This scenario is based off of Gov. Hochul's plan to have 31% of NY households electrified by 2030 and continuing at the same trajectory to 2050. | **RESOTHR2: Residential Other Electrification Low** - This scenario assumes that 50% of households will be electrified by 2030 and continuing at the same trajectory to 2050. | **RESOTHR3: Residential Other Electrification High** - This scenario assumes that 70% of households will be electrified by 2030 and continuing at the same trajectory to 2050. |
| Commercial | Building shell efficiency | **COMSHEL1: Commercial Building Shell Reference -** This scenario uses the assumptions from the NY State Integration Analysis reference scenario which says that by 2030, 3% of | **COMSHEL2: Commercial Building Shell Low -** This scenario uses the assumptions from the NY State Integration Analysis scenario 1 which says that by 2030, 3% of commercial | **COMSHEL3: Commercial Building Shell High -** This scenario uses the assumptions from the NY State Integration Analysis scenario 4 which says that by 2030, 7% of commercial |

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| | | commercial buildings will have a Deep Shell and 4% a Basic Shell and by 2050, 5% of commercial buildings will have a Deep Shell and 10% will have a Basic Shell. A more efficient building shell translates into a reduction in space heating and air conditioning needs. | buildings will have a Deep Shell and 10% a Basic Shell and by 2050, 12% of commercial buildings will have a Deep Shell and 56% will have a Basic Shell. A more efficient building shell translates into a reduction in space heating and air conditioning needs. | buildings will have a Deep Shell and 18% a Basic Shell and by 2050, 26% of commercial buildings will have a Deep Shell and 66% will have a Basic Shell. A more efficient building shell translates into a reduction in space heating and air conditioning needs. |
| Commercial | Electrification | **COMELEC1: Commercial Electrification Reference -** Using the reference scenario from the NY state Integration Analysis, this scenario assumes that 2% of commercial buildings are electrified by 2030 and 3.5% by 2050 | **COMELEC2: Commercial Electrification Low -** Using the scenario 1 from the NY state Integration Analysis, this scenario assumes that 11.5% of commercial buildings are electrified by 2030 and 94% by 2050 | **COMELEC3: Commercial Electrification High -** Using the scenario 4 from the NY state Integration Analysis, this scenario assumes that 27% of commercial buildings are electrified by 2030 and 99% by 2050 |
| Industrial | General efficiency measures | **INDEFF1: Industrial Efficiency Reference -** Using the reference scenario from the NY state Integration Analysis, this scenario assumes a 10% increase in industrial efficiency by 2025. | **INDEFF2: Industrial Efficiency Low -** Using the scenario 1 from the NY state Integration Analysis, this scenario assumes a 10% increase in efficiency by 2025, 30% by 2050. | **INDEFF2: Industrial Efficiency High -** Using the scenario 2 from the NY state Integration Analysis, this scenario assumes a 20% increase in efficiency by 2030, 40% by 2050. |
| Industrial | Electrification of non-fossil equipment | Same as baseline scenario. Based on the reference scenario from the NY state Integration Analysis, no changes are applied. | **INDELEC1: Industrial Electrification Low -** This scenario is based on the scenario 1 from the NY state Integration Analysis whereby 4% of natural gas use is electrified by 2030 and 33% by 2050. | **INDELEC2: Industrial Electrification High -** This scenario is based on the scenario 4 from the NY state Integration Analysis whereby 4% of natural gas use is electrified by 2030 and 83% by 2050. |

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| Agriculture | Fertilizer | Same as baseline scenario. | **SOILFERT1: Alternate Fertilizer Low -** This scenario assumes that by 2030, 25% of fertilizer use switches from synthetic sources to organic sources including dried manure and activated sewage, and 50% by 2050. | **SOILFERT2: Alternate Fertilizer High -** This scenario assumes that by 2030, 50% of fertilizer use switches from synthetic sources to organic sources including dried manure and activated sewage, and 80% by 2050. |
| Agriculture | Manure management | Same as baseline scenario. | **MANURE1: Biogas capture Low** - Using the same assumptions as the NY state Integration Analysis, this scenario assumes that by 2030, 50% of emissions from manure will be captured, and 76% by 2050. | Same as low ambition scenario |
| Agriculture | Alley Cropping | Same as baseline scenario. | **ALLEY1: Alley cropping low -** This scenario assumes a reduction of 0.140 MMT CO2e/yr downscaled from the state-level mitigation estimates from McDonnell and Sullivan (2020). | **ALLEY2: Alley cropping high -** This scenario assumes a reduction of 0.174 MMT CO2e/yr downscaled from the state-level mitigation estimates from McDonnell and Sullivan (2020). |
| Agriculture | Fertilizer management | Same as baseline scenario. | **FERTMNG1: Fertilizer management low -** This scenario assumes a reduction of 0.052 MMT CO2e/yr downscaled from the state-level mitigation estimates from McDonnell and Sullivan (2020). | **Same as low ambition scenario** |
| Agriculture | Cover Crops | Same as baseline scenario. | **COVRCRP1: Cover crops low -** This scenario assumes a reduction of 0.215 | **COVRCRP2: Cover crops high -** This scenario assumes a reduction of 0.221 |

| Sector | Sub-sector | Existing Policy Scenario | Low Ambition Policy Scenario (meeting 85% reduction in emissions by 2050) | High Ambition Policy Scenario (beyond 85% reduction in emissions by 2050) |
|---|---|---|---|---|
| | | | MMT CO2e/yr downscaled from the state-level mitigation estimates from McDonnell and Sullivan (2020). | MMT CO2e/yr downscaled from the state-level mitigation estimates from McDonnell and Sullivan (2020). |
| **Land Use** | **Reforestati on of Former Ag Land** | Same as baseline scenario. | **AFOREST1**: This scenario is based on McDonnell (2020) analysis of the low ambition mitigation effect of afforestation of agricultural land in New York State. Considering the proportion of crop area in the Genesee-Finger Lakes region to that of the entire state the scenario assumes a reduction GHG Mitigation of 0.989 MMT CO2e/yr | **AFOREST1**: This scenario is based on McDonnell (2020) analysis of the high ambition mitigation effect of afforestation of agricultural land in New York State. Considering the proportion of crop area in the Genesee-Finger Lakes region to that of the entire state the scenario assumes a reduction GHG Mitigation of 1.272 MMT CO2e/yr |
| **Waste** | **Landfill gas / biogas manageme nt** | Same as baseline scenario. | Same as baseline scenario | Same as baseline scenario. |

# 7 Scenario analysis results

The results of the scenario analyses are presented in this section. The emissions reduction possible in each scenario are compared to the targets set forth in the CLCPA of 40% reduction of gross emissions by 2030 compared to 1990 emissions, 85% reduction of gross emissions by 2050 and net zero emissions by 2050.

## 7.1 Existing policy scenario

Under the existing policy scenario, the total amount of emissions reductions achieved through the implementation of existing plans and policies is 10.57 Million Metric Tons of Carbon Dioxide Equivalent (MMTCO$_2$e) by 2050. This is equivalent to a 34% reduction in emissions compared to 1990 emissions, meaning that the CLCPA target for 2050 is not achievable through existing policies.

Around 57% of the emissions reductions is from transportation, followed by 21% from decarbonizing the grid and 20% from building efficiency and electrification.
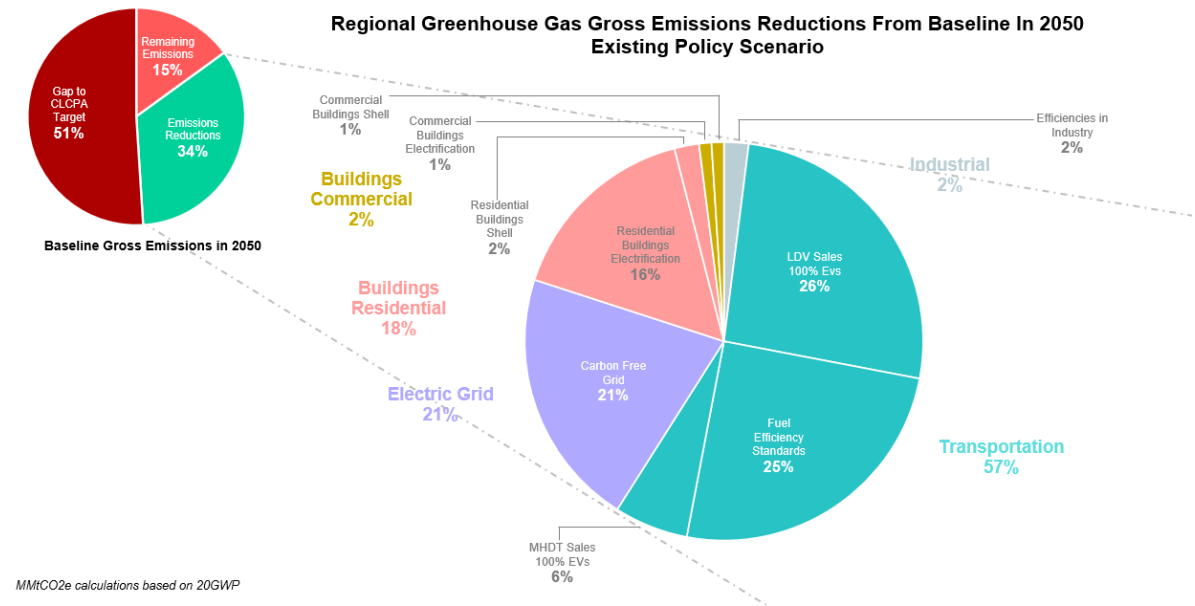


*Figure 4: Results of Existing Policy Scenario*

## 7.2 Existing policy scenario + low ambition

Under the existing policy plus low ambition scenario, the total amount of emissions reductions achieved is 18.57 MMTCO$_2$e by 2050. This is equivalent to a 61% reduction in emissions compared to 1990 emissions, meaning that the CLCPA target for 2050 is not achievable through even with more ambitious policies.

Compared to the previous scenario where the emissions reduction from agricultural sector were limited, the agricultural sector has around 14% of the emissions reduction in this scenario. This is because most of the focus of the state-level policies are around transport and residential since agriculture only makes up 6% of the state's emissions. Since agriculture plays a much larger role in the region, there is more emphasis on agricultural mitigation measures.
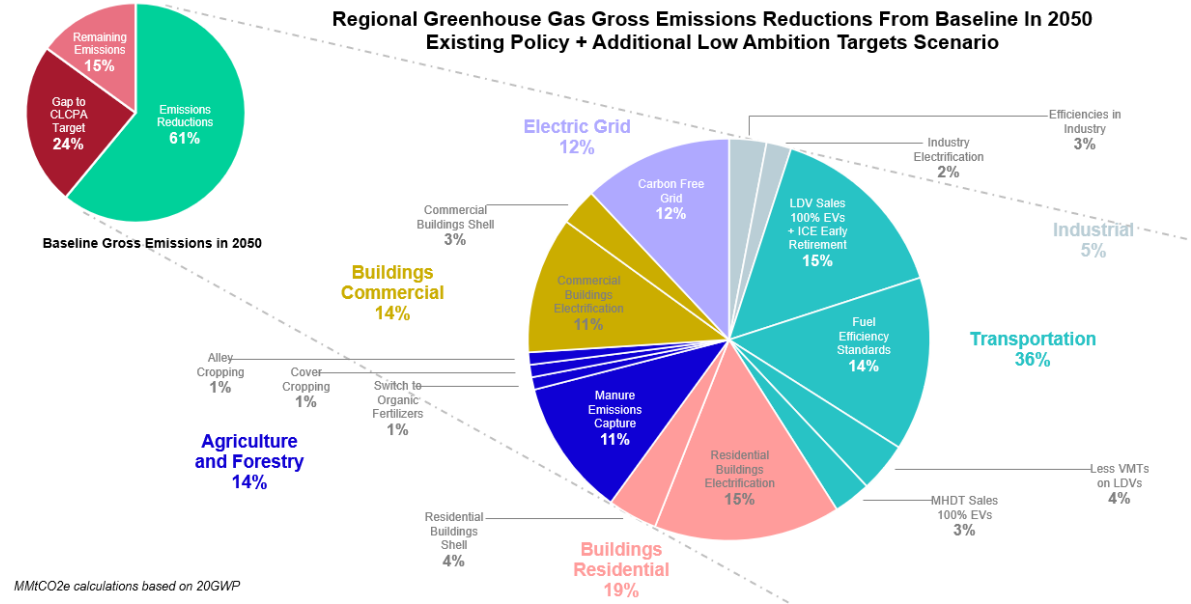


Figure 5: Results of Low Ambition Scenario

## 7.3 Existing policy scenario + high ambition

Under the existing policy plus high ambition scenario, the total amount of emissions reductions achieved is 20.27 MMTCO$_2$e by 2050. This is equivalent to a 66% reduction in emissions compared to 1990 emissions, meaning that the CLCPA target for 2050 is not achievable through even with more ambitious policies.

The remaining 19% of emissions that prevents us from meeting the CLCPA goals are from solid waste (landfill) emissions and agricultural emissions. The region hosts the largest landfills in the state with waste coming in from all over New England, Canada as well as New York. Despite significant landfill capture measures, there is still some methane leakage occurring that might be difficult to contain simply due to the landfill size.

For the agricultural sector, the emissions that remain are primarily from enteric fermentation processes of dairy cows. As mentioned in Section 5, while there is significant research into alternative feed and diets to reduce enteric fermentation emissions, the scale of their uptake is unclear.
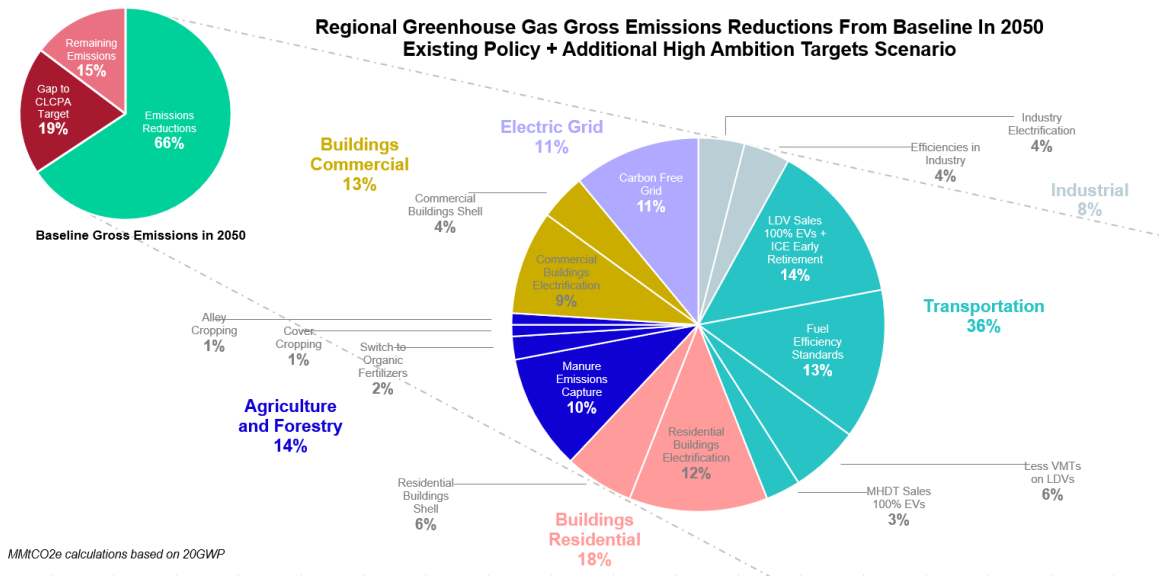
*Figure 6: Results of High Ambition Scenario*

## 7.4   Summary of regional emission scenarios

A summary of the findings from the scenarios is presented in Figure 7 below. The Existing Policy + High Ambition scenario achieves the intermediate 2030 target due from the suggested emission reduction measures proposed. As mentioned in Section 5, there are several scenarios that we were unable to quantify at this time. It is possible that the CLCPA goals could be achieved if additional data is made available to enable the quantification of all proposed measures.
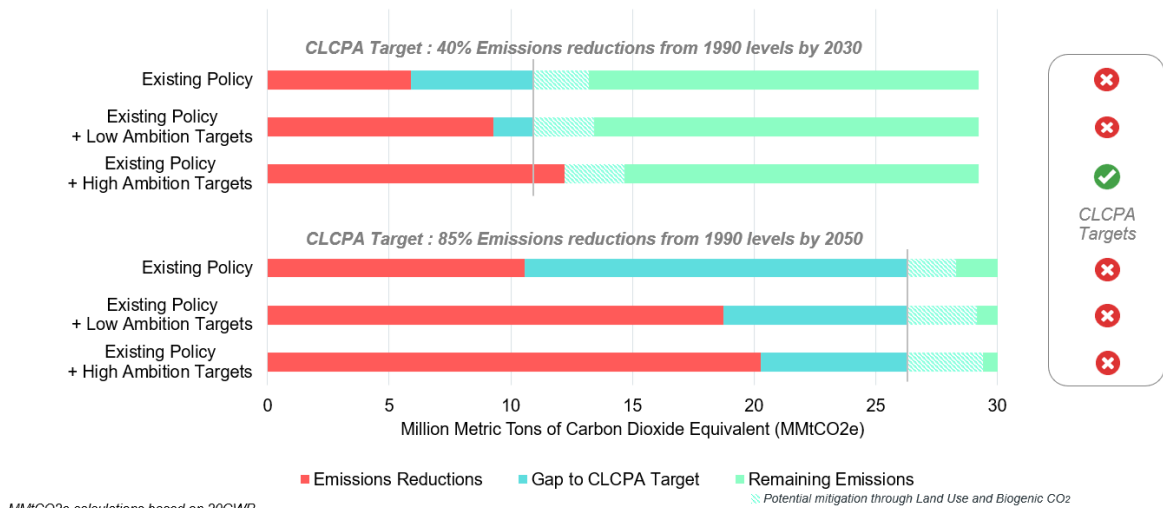


*Figure 7: Comparison Between Regional Greenhouse Gas Emissions Mitigation Scenarios*

# APPENDIX A

April 2021 Survey Questions

# Appendix A: April 2021 Survey Questions

| Question Number | Question Text |
|---|---|
| Q1 | Many climate solutions can be used to address other areas of community need. To better understand what community needs, please select your top three priorities for our Region. <br>• Access to clean water<br>• Affordable housing<br>• Air quality<br>• COVID relief<br>• Criminal justice/police reform<br>• Drug abuse prevention or rehabilitation<br>• Economic development<br>• Education improvements<br>• Employment opportunities<br>• Energy costs<br>• Eviction prevention<br>• Extreme weather events<br>• Food access/quality<br>• Health care access/quality<br>• Local government reform<br>• Open space improvements<br>• Racial justice<br>• Recreational opportunities<br>• Renewable energy development<br>• Transportation improvements<br>• Violence prevention/reduction<br>• Other_____ |
| Q2 | Climate solutions can provide additional benefits to local communities. Select your top three priorities for solutions that both reduce greenhouse gas emissions and provide community benefits.<br>• Active transit opportunities (e.g. bike lanes and sidewalks) that improve air quality by reducing the need for fossil fuel vehicles and improve the walkability of our communities<br>• Agricultural practices that can increase agricultural yield and the availability of nutritious food while improving water quality of nearby waterways<br>• Brownfield remediation projects that address environmental hazards and increase property values |

| Question Number | Question Text |
| --- | --- |
| | • Clean energy job opportunities that improve our infrastructure and provide above average wages and benefits<br>• Composting programs that reduce harmful emissions by keeping food scraps out of landfills and generating sustainable sources of fertilizer<br>• Efficient clean heating and cooling technologies that improve home comfort and indoor air quality by providing heat and air conditioning without burning fossil fuels<br>• Electrical grid improvements that accommodate more renewable energy sources and reduce the likelihood of power outages<br>• Energy efficiency and weatherization improvements that reduce household utility costs indoor air pollutants mold and pests while making the home more comfortable for residents<br>• Land use planning decisions that locate amenities e.g. grocery stores urban farms/farmers markets and parks in local neighborhoods creating more walkableprosperous communities<br>• Open space and green space development that provides recreational opportunities and reduces temperatures<br>• Public transportation improvements that reduce commute times and improve access to jobs and services<br>• Renewable energy projects that reduce our dependence on imported fossil fuels<br>• Sustainability related research and development to position our Region as a leader in next generation energy technologies<br>• Sustainability-themed businesses that provide local economic development opportunities<br>• Other:_____ |
| Q3 | What is your level of knowledge or understanding about how climate change will impact our Region?<br>• I don't care about how climate change will impact our Region.<br>• Not at all knowledgeable<br>• Not very knowledgeable<br>• Somewhat knowledgeable<br>• Very knowledgeable |
| Q4 | What is your level of knowledge or understanding about what climate solutions are appropriate for our Region?<br>• I don't care about which climate solutions are appropriate for our Region.<br>• Not at all knowledgeable<br>• Not very knowledgeable<br>• Somewhat knowledgeable |

| Question Number | Question Text |
|---|---|
| | • Very knowledgeable |
| Q5 | What is your level of knowledge or understanding about climate or environmental justice?<br>• I don't care about climate or environmental justice.<br>• Not at all knowledgeable<br>• Not very knowledgeable<br>• Somewhat knowledgeable<br>• Very knowledgeable |
| Q6 | What is your level of knowledge or understanding about how to access energy efficiency programming or incentives?<br>• I don't care about accessing energy efficiency programming or incentives.<br>• Not at all knowledgeable<br>• Not very knowledgeable<br>• Somewhat knowledgeable<br>• Very knowledgeable |
| Q7 | What is your level of knowledge or understanding about how to access renewable energy programs and incentives?<br>• I don't care about accessing renewable energy programs or incentives.<br>• Not at all knowledgeable<br>• Not very knowledgeable<br>• Somewhat knowledgeable<br>• Very knowledgeable |
| Q8 | In your opinion, which of the following would be most helpful for increasing the adoption of energy efficiency and clean heating and cooling technologies in residential properties?<br>• Ban all gas hookups in new building construction.<br>• Educate property owners about the importance of reducing energy use and the availability of programs that can help them reduce energy usage.<br>• Increase financial incentives for weatherization measures (e.g. insulation and air sealing) and clean heating and cooling technologies (i.e., heat pumps).<br>• Reduce paperwork and other requirements to simplify and streamline the process of enrolling in residential energy programs.<br>• Require landlords to meet energy efficiency standards to receive a certificate of occupancy for a property. |

| Question Number | Question Text |
|---|---|
| | • Other:_____ |
| Q9 | In your opinion, which of the following transit options should be prioritized?<br>• Expanding access to electric vehicle charging stations<br>• Expanding bike lanes and bike paths<br>• Expanding sidewalks and pedestrian plazas to create safer, more walkable communities<br>• Expanding the geographic reach and efficiency of public transit<br>• Other:_____ |
| Q10 | In your opinion, which of the following land use and development options should be prioritized?<br>• Consolidate/merge local governments to better coordinate development and reduce inefficiency<br>• High-density development that makes alternative transit (e.g., walking, biking, and public transit) more feasible, and preserves open space and agricultural lands<br>• Inter-municipal and regional community planning that designates priority development and conservation areas, curbs inefficient development and over-development, revitalizes cities and villages, and preserves open space and agriculture<br>• Overhaul current zoning codes and rules to increase flexibility, innovation, and access<br>• Other:_____ |
| Q11 | In your opinion, which of the following agricultural practices should be prioritized?<br>• Co-developing agricultural land for renewable energy projects (e.g., solar and wind projects) and agricultural production (e.g., sheep farming, beekeeping, fruit and vegetable production)<br>• Convert waste to energy by using animal and crop waste to create biogas for electricity<br>• Develop a soil health label similar to the organic label that indicates sustainable agricultural practices<br>• Educate farmers about climate-friendly agricultural practices<br>• Modify crop insurance programs to provide protections for farmers practicing climate-friendly agricultural production<br>• Provide payment to farmers for ecosystem services (e.g., carbon sequestration, soil health, pollinator services, improving water quality)<br>• Other:_____ |

| Question Number | Question Text |
|---|---|
| Q12 | In your opinion, which of the following technologies are appropriate for our Region?<br>• Expanding hydrogen fuel cell production<br>• Expanding nuclear production capabilities<br>• Expanding renewable natural gas (or biogas)<br>• Expanding solar farms<br>• Expanding utility-scale energy storage facilities<br>• Expanding wind farms |
| Q13 | In your opinion, which of the following best captures why climate solutions have not been widely implemented in our community?<br>• Many perceive that the necessary technology to address climate change has not yet been developed.<br>• Public perceptions that the costs associated with addressing climate change exceed the benefits of taking action.<br>• There is a lack of knowledge about local climate change impacts and potential solutions.<br>• There is a lack of political will and community leadership in prioritizing climate change in our community.<br>• Other:_____ |
| Q14 | In your opinion, how should we fund climate solutions?<br>• Corporations should pay a carbon fee or taxes for greenhouse gas emissions.<br>• Individuals should be willing to pay more for climate-friendly products and services.<br>• The government should prioritize funding for climate solutions without raising taxes.<br>• The government should raise taxes to fund climate solutions.<br>• Other:_____ |
| Q15 | In your opinion, what is most needed to address climate change in our Region?<br>• Education. People do not understand what needs to be done to address climate change.<br>• Laws. People will not take action to address climate change unless required.<br>• Leadership. People are hesitant to take action because they do not want to be the first in their communities to do so.<br>• Money. The Region does not have the resources necessary to take action.<br>• Other:_____ |

| Question Number | Question Text |
|---|---|
| Q16 | How willing are you to adopt sustainability measures in your own life/household?<br>• Not at all willing<br>• Not very willing<br>• Somewhat willing<br>• Very willing |
| Q17 | What barriers prevent you from adopting sustainability measures in your own life/household?<br>• I already take advantage/implement the full range of sustainability measures.<br>• I do not have the necessary financial resources to implement sustainability measures.<br>• I do not have the necessary knowledge to implement sustainability measures.<br>• I do not have the necessary time to implement sustainability measures.<br>• I do not own my own house and that largely prevents me from implementing sustainability measures.<br>• Implementing sustainability measures is not something I am interested in.<br>• Other:_____ |
| Q18 | If you could implement one solution to address a community or neighborhood need, what would it be? |
| Q19 | What is your zip code? |
| Q20 | Which of the following best describes you? Please select one answer.<br>• White or Caucasian<br>• Hispanic or Latino<br>• Multiracial/Biracial<br>• Black/African American<br>• Asian or Pacific Islander<br>• Native American or Alaskan Native<br>• Other: _____ |
| Q21 | What is your household size?<br>• 1<br>• 2<br>• 3<br>• 4<br>• 5 |

| Question Number | Question Text |
|---|---|
| | • 6<br>• 7<br>• 8+ |
| Q22 | Which of the following best captures your annual household income?<br>• <$25K<br>• $25-$50K<br>• $50-$75K<br>• $75-$100K<br>• $100-$125K<br>• >$125K |
| Q23 | What is your highest level of education completed?<br>• Grade school<br>• High School<br>• Associates or trade degree<br>• Bachelor's degree<br>• Advanced degree |
| Q24 | Which of the following best describes you? - Selected Choice<br>• Woman<br>• Man<br>• Non-Binary<br>• Prefer not to answer<br>• Prefer to self-identify:_____ |